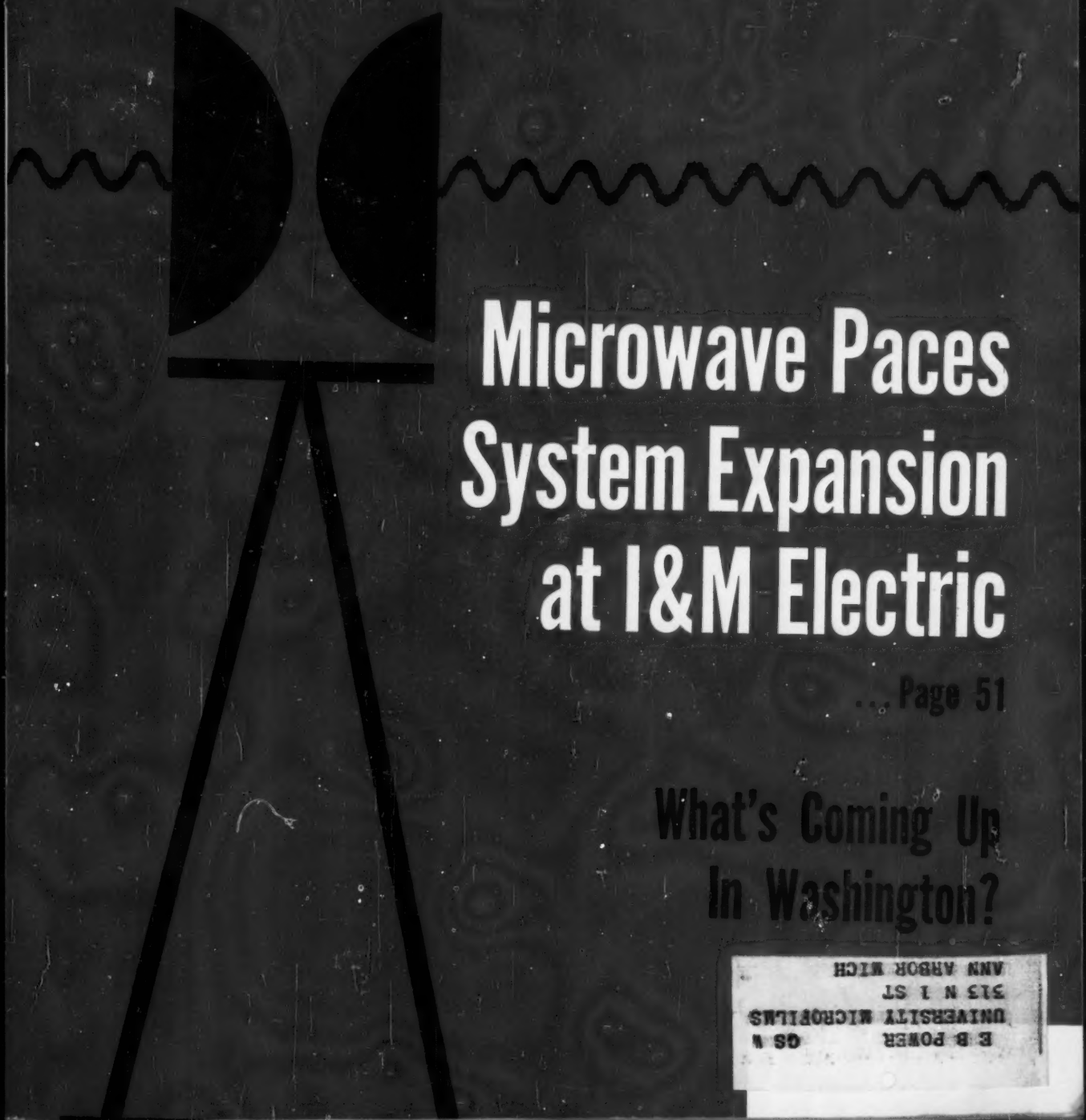
The Electrical Industry's Weekly Magazine

January 6, 1958

Electrical World

Price 50 Cents

A McGraw-Hill Publication



Microwave Paces System Expansion at I&M Electric

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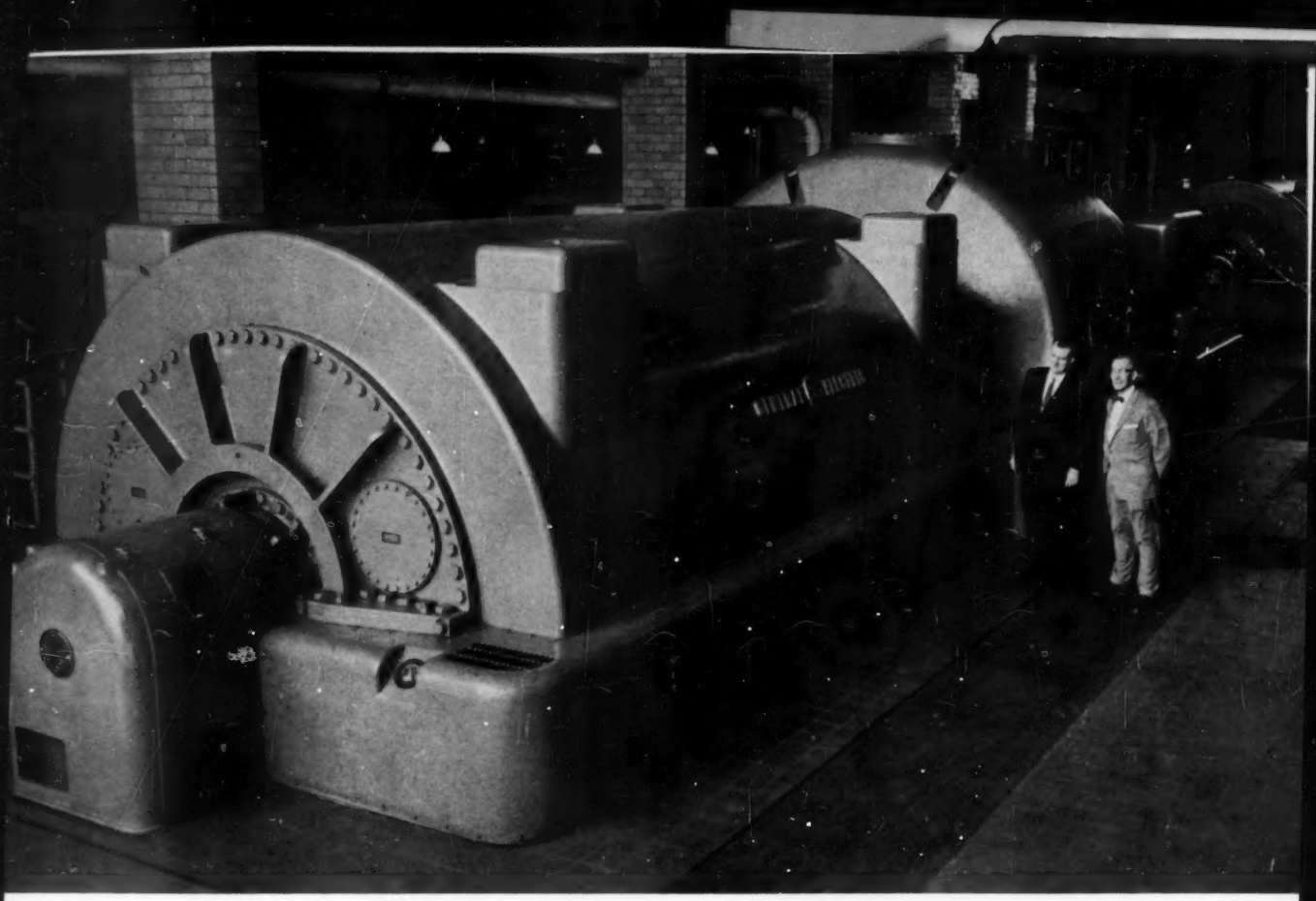
What's Coming Up In Washington?

E S POWER QS \
UNIVERSITY MICROFILMS
313 N 1 ST
ANN ARBOR MICH



This new 70,000 kw reheat turbine—like all other turbines in this plant—is 100% Texaco-lubricated to keep it free from rust, sludge and foam.

A large Eastern Utility found:

Texaco gives these 3 big benefits for complete turbine protection:

1. Unquestionable dependability. Texaco Regal Oil R&O keeps the utility's turbine system clean; prevents rust, sludge and foam from forming; keeps bearing temperature normal and governor response instantaneous. Texaco dependability is a *fact* for this utility, based on long experience.

2. High efficiency. Texaco Regal Oil R&O assures smooth performance and freedom from unscheduled outages. Texaco Regal Oil R&O gives bearings full protection throughout an extra-long oil service life.

3. Technical service. Texaco offers this important benefit at a time when power demands are almost out-growing turbine production. Past experience in the power plants has proved Texaco Lubrication Engineering Service to be quick and reliable. This service is always available to Texaco customers—whatever the need.

There is a complete line of Texaco Regal Oils R&O to meet the requirements of all leading turbine manufacturers, regardless of turbine type or size. Let a Texaco lubrication expert help you select the Texaco Regal Oil R&O that will keep turbine efficiency high and maintenance costs at a minimum. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States—or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.

TUNE IN... Metropolitan Opera Radio Broadcasts Every Saturday Afternoon

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

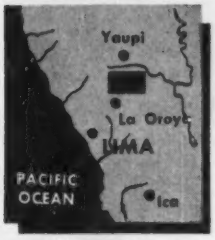
(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

Electrical World

Vol. 149, No. 1 JANUARY 6, 1958

Published for 84 years for these engaged in the business of generating transmitting, distributing, or applying electric power

In This Week's Issue



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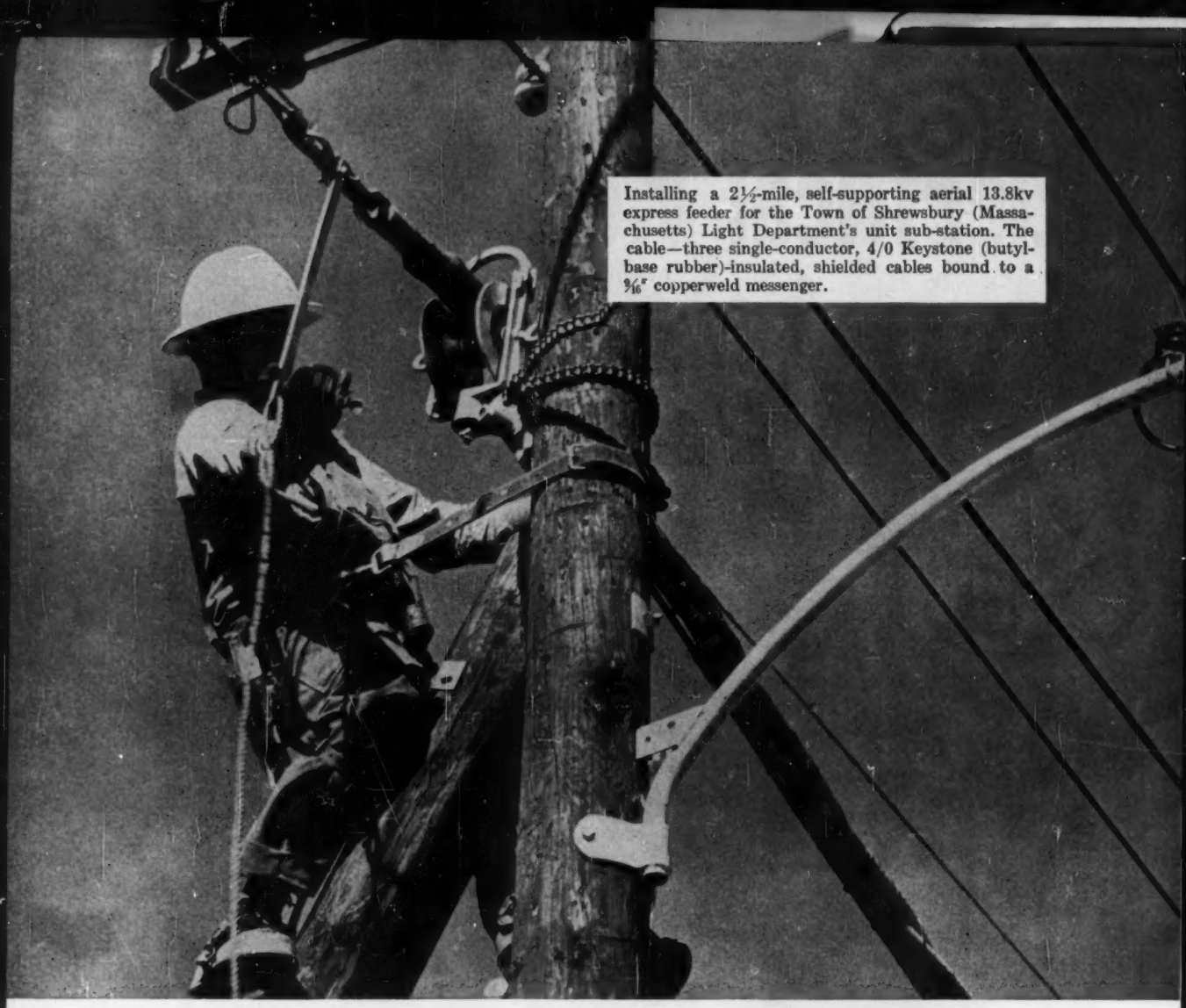

Installing a 2½-mile, self-supporting aerial 13.8kv express feeder for the Town of Shrewsbury (Massachusetts) Light Department's unit sub-station. The cable—three single-conductor, 4/0 Keystone (butyl-base rubber)-insulated, shielded cables bound to a 9/16" copperweld messenger.

Contractor: The Theodore D. Bross Line Construction Company

Modernize with Okonite self-supporting aerial cable...

The Town of Shrewsbury Light Department did just this when they recently installed a 13.8kv express feeder. They chose an Okonite self-supporting aerial cable because they wanted a superior installation that would practically eliminate tree trimming costs . . . be more reliable in storms (operate even with poles down) . . . reduce pole congestion . . . assure fewer interruptions or outages . . . have a moderate cost . . . provide improved voltage regulation because of lower reactance . . . and be more economical to operate and maintain than equivalent open wire lines.

In choosing Keystone (butyl-base rubber)-insulated cables for this important feeder, Shrewsbury Light Department was also banking on high voltage cable with a record for long and dependable service . . . high resistance to ozone and corona cutting . . . ability to take sharp bends . . . stable operation at copper conductor temperatures as high as 85C at 15kv . . . excellent resistance to moisture and extremes of temperatures.

For the complete story on Keystone-insulated cables, contact your Okonite representative . . . or write for Bulletin EW-463 where the results of field service and tests are reported with graphs and charts together with 36 pages of technical data.

The Okonite Company, Passaic, New Jersey.

where there's electrical power . . . there's **OKONITE CABLE**

4912

Christmas Parties Serve Purpose

Christmas parties by various units of the electrical industry are one of the highlights of the season. Of course identification with Christmas is not at all necessary. One is scheduled for January 8.

These parties have a varying base beginning with guests almost 100% customers to those which are almost 100% members of the magazine and newspaper fraternity. No matter what the objective, these are the best managed affairs in the world. This is true whether it is Irving Trust, Babcock & Wilcox, Middle South, General Electric or American & Foreign Power.

Rarely is any business openly discussed. But the groups of three or four guests and hosts are delving into every corner of the business picture. One is more likely to hear a discussion of the losses in the atomic power equipment field; or what the Florida group will do; than where the electrical business is headed.

The matter of maintaining an informed press is one of the main reasons for parties in New York. Newspaper men secure background on matters of a technical nature which is constantly causing trouble. Magazine editors hear inside stories that will be breaking. All together, the parties provide an essential means of communication for our industry.

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ELECTRICAL WORLD

Published weekly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), Founder. Executive, Editorial, Circulation, and Advertising Offices: McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Printed at 99-129 North Broadway, Albany 1, N. Y. See panel at right for circulation regarding subscriptions or change of address.

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Subscriptions are solicited from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields; and from consulting engineers and electrical engineers in industry. Position and company connection must be indicated on subscription orders. Send to address shown in box at right.

United States and Canada subscription rate for individuals in the field of the publication $6.00 per year; single copies 50 cents. Other Western Hemisphere and the Philippines $20.00 payable in advance and other countries $30.00 payable in advance.

Second-class mail privileges authorized at Albany, N. Y. Printed in U.S.A. Title registered in U. S. Patent Office.

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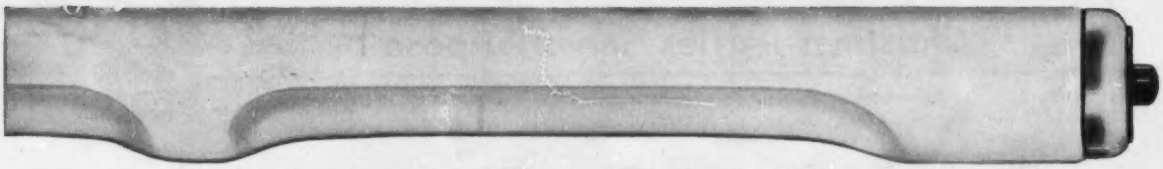
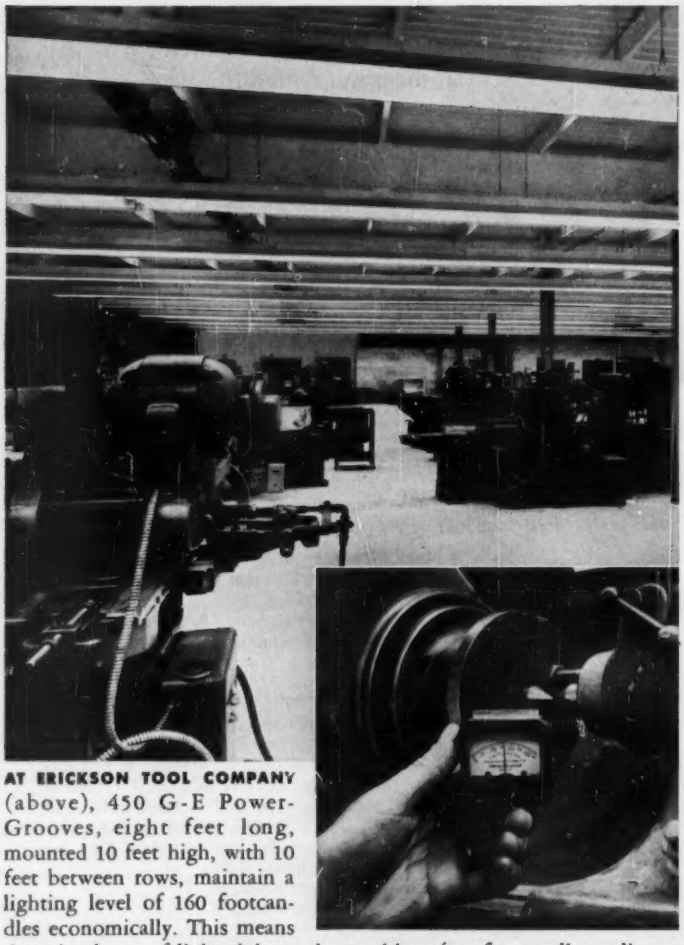
Postmaster . . . Please send form 3579 to Electrical World, 330 W. 42nd St., New York 36, N. Y.



The Powerful Power-Groove!

Radical new General Electric fluorescent lamp design can give your customers higher, more economical light levels



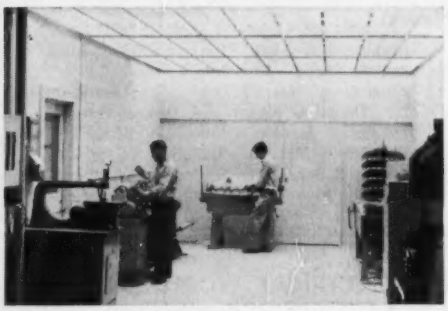
AT ERICKSON TOOL COMPANY (above), 450 G-E Power-Grooves, eight feet long, mounted 10 feet high, with 10 feet between rows, maintain a lighting level of 160 footcandles economically. This means there is plenty of light right at the machines (see footcandle reading at right)—where extra light means extra safety, extra accuracy for workers. No supplementary lighting is needed. Powerful Power-Grooves do it all!

While plans for their new building were still in the early stages, officers from Erickson Tool Company of Cleveland, Ohio, visited the Lighting Institute—General Electric's lamp headquarters at Nela Park. There they saw the whole array of lighting methods and discussed the powerful new G-E Power-Groove Lamps.

They were shown how these revolutionary lamps provide outstanding general lighting, making it unnecessary to use supplemental lighting on individual machines (like that used by Erickson toolmakers in their old plant). They saw how powerful Power-Grooves would fill a plant with pleasant light that's easy on the eyes . . . as well as the pocketbook. The decision was made: Erickson's new plant would have G-E Power-Groove Lamps throughout!

Because G-E Power-Groove Lamps give nearly twice as much light per tube as High-Outputs—2½ times as much as 8-foot slimlines—your customers can get more light per fixture—with fewer parts to maintain. And compared to other fluorescent systems, they can save 5-20% on their initial investment.

Get the whole exciting Power-Groove story. Write General Electric Co., Large Lamp Dept. EW-18, Nela Park, Cleveland 12, Ohio. Better still, visit Nela Park and let us show you on-the-spot demonstrations of how the powerful Power-Grooves can work for your customers.



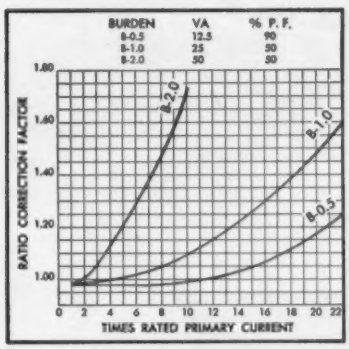
WORLD'S BRIGHTEST WORKSHOP—Now you can see powerful Power-Grooves in action . . . lighting the world's brightest workshop. It's at the G-E Lighting Institute at Nela Park. Plan to visit it and see for yourself.

Progress Is Our Most Important Product

GENERAL ELECTRIC

NEW 5-Kv Molded CURRENT TRANSFORMER

...for Indicating and Tripping Service



Typical 60-cycle overcurrent curves for Type LRM current transformer.

Extends Line of Maintenance-free Epoxy-resin Units

Latest in a growing family of molded units, this Type LRM current transformer rated 5 kv is already a prime favorite with panel and switchgear designers. Molded of epoxy resin, this new transformer is virtually maintenance-free. It has high impact strength . . . resists mechanical forces, moisture and fire. These advantages at no extra cost.

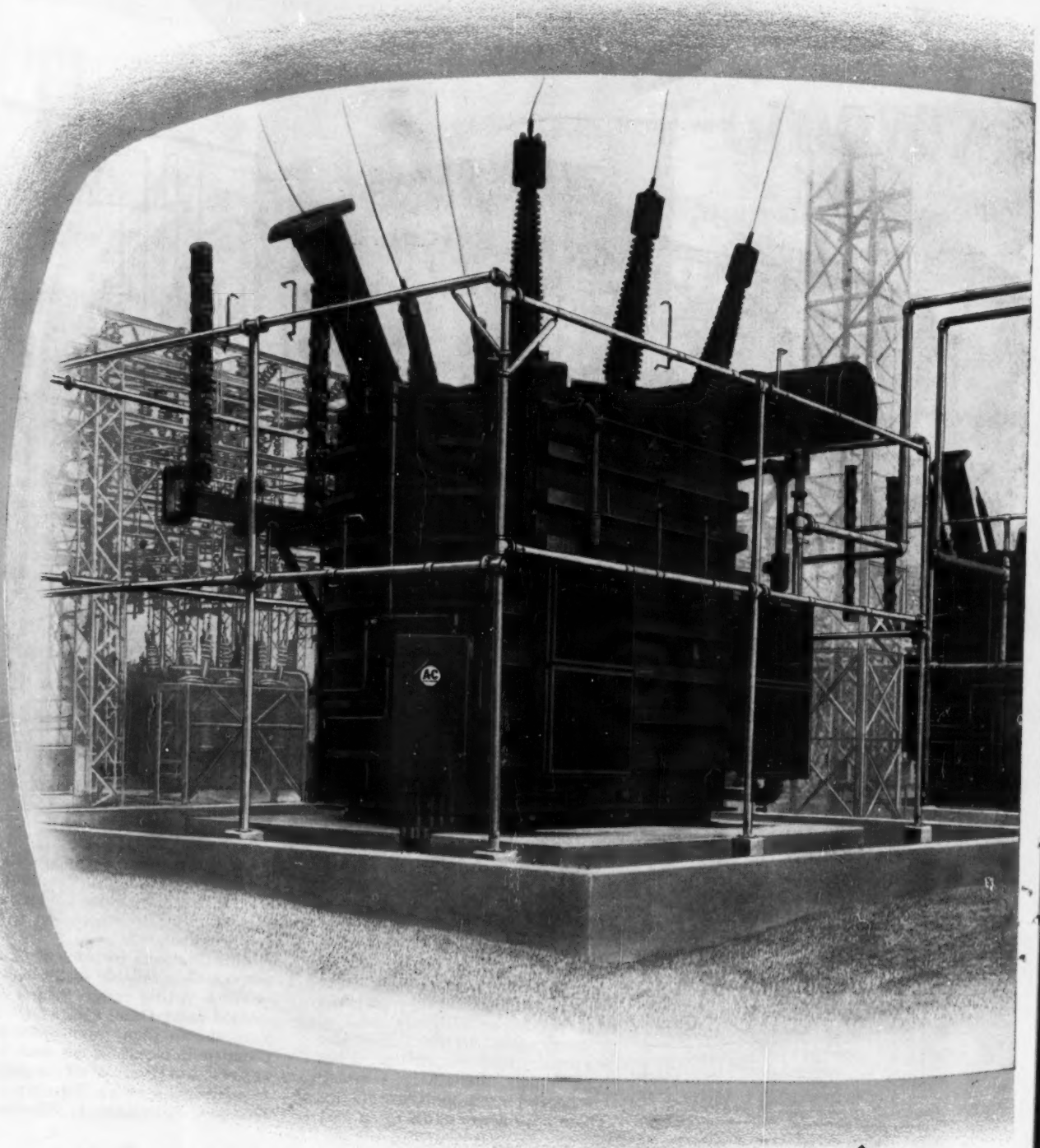
All units are supplied with a short-circuiting strap, removable after installation. Base design permits mounting anywhere—on walls, bars, channels, etc.

Allis-Chalmers instrument transformers are available in the widest possible rating range. Many are molded units. Other epoxy-resin designs are in pilot production. For complete information, see your A-C representative, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5503

Another example of Allis-Chalmers



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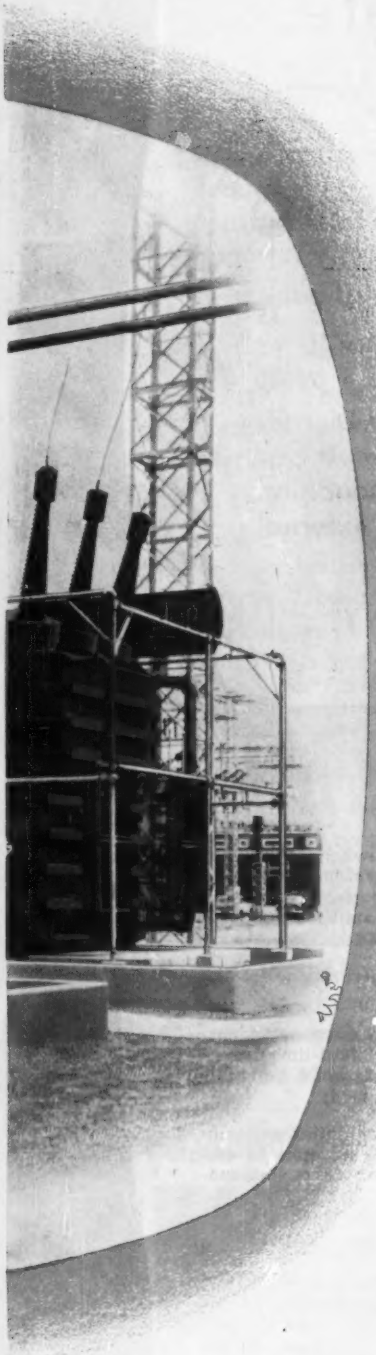
leadership in transformers



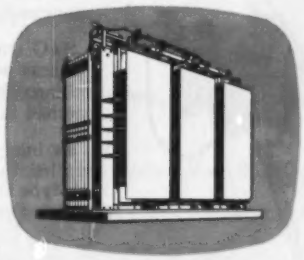
Two 150,000-kva Autotransformers for Duke Power Co. tie 115-kv and new 230-kv lines

The use of autotransformers in the size range of the 150,000-kva units shown here allows new savings possibilities. That's why today's trend toward autotransformers is receiving increased attention.

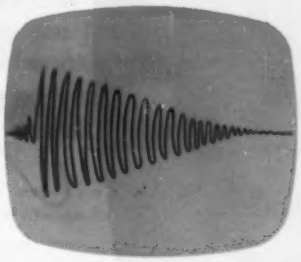
For example, it is estimated that these units cost about 40% less than conventional transformers. In addition, they are smaller, more efficient and have lower impedance.

Allis-Chalmers autotransformers are available in single or three-phase types with or without load tap changing, in all kva and voltage sizes for: interconnection of systems, phase shifting, or generating station step-up service.

For details call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



Circular coil, shell form construction used in these transformers is inherently strong, provides high impulse strength, good impulse voltage distribution.



New switching surge test plus standard impulse test subjects transformer to overvoltage surge conditions found in actual operation.

ALLIS-CHALMERS

Note this Nameplate Carefully—

TOOL OPERATED DISCONNECT

CAT. NO:	4752	KV, NOMINAL:	15
KV, MAX. DES:	15	KV, IMP. WITH:	95
AMP, CONT:	400	AMP, MOM:	20000

This is an S&C Tool Operated Disconnect. Used with S&C's Loadbuster, it can switch the circuit under any condition except short circuit—without external arcing.

U S PATENTS PENDING

S&C ELECTRIC COMPANY
CHICAGO

Made in U. S. A. G-3448

It means—

1. universal low cost load switching throughout your distribution system by use of LOADBUSTER®, the portable loadbreak tool; for loads up to 400 amperes and with system voltages through 14.4 kv;

2. station-type disconnect performance at distribution disconnect prices;

3. S&C stands behind this disconnect's performance with full published short-time ratings and insulation values—values which cannot be matched in the distribution field;

4. an inexpensive device for duties normally handled by group-operated disconnects, station-type stick operated disconnects, and conventional load interrupters.

Now look how Loadbuster works

Attached to a universal pole, LOADBUSTER is simply hung on the attachment hook of this new Tool Operated Disconnect, and the pull ring hook inserted in the pull ring. As the pole is pulled downward the disconnect is opened, LOADBUSTER trips, breaking the circuit positively. It's that easy!

S&C Electric Company, 4421 Ravenswood Avenue, Chicago 40, Illinois.
In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.

The News-Scope

LATE NEWS

AEC has reorganized. Division of Civilian Application (handling both regulatory and non-regulatory functions) has been abolished. This will be replaced by: Division of Licensing and Regulation, and Office of Industrial Development. Harold E. Price, former director of CA, will head up the former; Dr Frank Pittman, the latter.

First power from Portland General Electric's $25-million Pelton Dam starts flowing into Northwest Power Pool. PGE claims a record time between signing of contract and operation for a major hydro plant. (Time: 20 months, 2 days).

In current municipality-vs co-op fight, Joe Wheeler Electric Membership Corp votes to reduce its rates within police jurisdiction of Decatur (Ala.), in effort to keep Decatur from taking its customers. Co-op and Decatur electric dept have been feuding over servicing a new construction site outside city limits but within Decatur police jurisdiction.

AEC said its experimental aqueous homogenous Reactor No. 2 (RE-11) achieved criticality on Dec. 27. This is the sixth experimental or power reactor to go into operation in the U.S. in 1957. Slated to start up in Dec., 1956, it was delayed by flange cracking in the leak detector system Capable of delivering 300-kw, it will provide data for Pennsylvania P&L's reactor.

Management promotions . . . W. O. Smith becomes VP-gas and electric sales, at Long Island Lighting and C. E. Elbert, secretary, assumes added duties as assistant to Pres J. J. Tuohy . . . R. D. Maxson resigns as Commonwealth Edison's senior VP to become a senior consulting engineer to Sargent & Lundy and Commonwealth Ed.

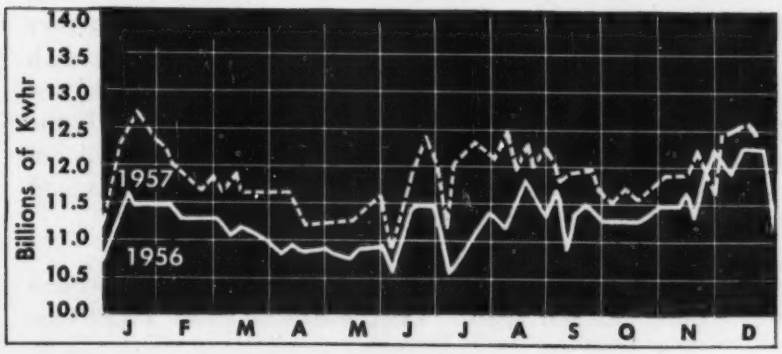
FUTURE NEWS

A decision by the Kansas State Corporation Commission will be forthcoming on a request by 29 electric co-operatives of Kansas to cancel operating certificates of electric utilities where the co-op certificates overlay the territory. Should this application be granted, the co-ops would have a monopoly to serve all customers in about 90% of the land area of Kansas.

Because of the defense spending program, look for reduced appropriations for the REA in President Eisenhower's annual budget to Congress soon to be released.

Washington sources say that Sen Wayne Morse (D-Ore.) may try again to revive his Hell's Canyon bill, even at this late date . . . **Lobbying Act may be revised as** proposed last year by **Sen John L. McClellan** (D-Ark.) bill. This would affect some advertising activities of electric companies.

Power Output—Up 1.5% (Week ending Dec. 21), Kwhr 12,412,000,000



Per Cent Change From Previous Year

	Dec. 7	Dec. 14	Dec. 21
Total U. S.	+2.2	+2.9	+0.6
New Eng.	+2.9	+1.2	+0.7
Mid. Atlan.	+2.3	+2.3	−1.7
Cent. Ind.	+0.1	+0.0	+1.2
West Cent.	+1.6	+1.5	+2.8
Southeast	+4.8	+7.1	+5.8
South Cent.	+4.2	+5.8	+4.9
Rocky Mount.	+2.1	+2.8	+2.5
Pacific			
NW	−2.5	−2.3	+5.4
SW	+4.7	+3.9	+1.5

Seasonally Adjusted Index 224.8

Week Ago 221.2 Year Ago 228.9

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 2.3%

The Electrical Week

ATOMIC PROGRESS ▶ **Two utility nuclear groups propose launching development of an advanced nuclear power reactor. Prototype would be 50-Mw unit leading ultimately to construction of 200-Mw plant (p 37).**

WASHINGTON ▶ **Increased urgency for defense spending, plus pressures for domestic economy, are sure to affect congressional outlooks on some power legislation. Big issues ahead are TVA financing, atomic power, and "partnership" on the Trinity (p 36).**

EVENTS ▶ **Peru's 65-Mw Paucartambo River hydroelectric project is finished, despite staggering engineering obstacles posed by Andes (p 40).**

GENERATION ▶ **Want to save $50,000 annually in steam-plant fuel costs? This is the order of savings you may get by improving by 1% the heat rate of three 100-Mw machines. But how do you know whether an overhaul can be economically justified? The answer to this question can be given by an electronic computer. Georgia Power is using an IBM 650 to whip out quickly heat rate calculations that ordinarily would cost 500 to 600 man-hr. Object of the computer program is this: To maintain turbine efficiency at the most economic overhaul point. Design Engineers C. F. Whitmer and W. M. Stephens relate here details of the test setup and procedure followed (p 44).**

DISTRIBUTION ▶ **If a top-efficiency distribution transformer is to be made for the lowest price, utilities will have to agree upon what copper-to-core loss ratio they want. This ratio may affect (1) materials cost, (2) resistance, (3) reactance, and (4) regulation. Economical mass production of transformers to meet the needs of all users requires adoption of set loss ratio for the design. Author J. B. Hodtum presents here for the first time a group of formulas and curves aimed at helping utilities determine what they want in future transformers (p 47).**

RELAYING ▶ **Northern States Power has simplified its protective scheme for substations "inserted" into existing transmission lines. The scheme uses only phase-comparison carrier-current relays for primary protection of 115-kv lines; backup protection comprises line-impedance and directional-overcurrent ground relays at the remote end. This system reduces the amount of relaying equipment and number of power transformers needed. With phase-comparison relays in service, each line will trip simultaneously at both ends for internal faults, says author Rubin Zimering. With these relays out of service, only the remote-end breakers will trip. Failure of carrier current will not prevent tripping by phase-comparison relays for internal faults, and tripping would not be blocked for external faults (p 53).**

COMMUNICATIONS ▶ **Microwave is the answer to Indiana & Michigan Electric's problem of communications and control. The company chose a 2,000-mc**

system using single-sideband multiplexing. Channeling will include service and fault indicating circuits, talk circuits, supervisory substation control circuit, and facsimile recording and transmitting circuits. The initial installation promises reliable, high-quality, and accurate channeling for present needs, and flexibility for the future. I&M's System Communications Supervisor W. R. Roy also discusses tower strengths and why I&M chose the narrowest bandwidth for 24 channels in the industry (p 51).

NEW EQUIPMENT ▶ **Lightning arresters combine external gap** with electrical characteristics of valve and internal-gap construction . . . Current transformer is silicone-insulated for indoor metering and relaying (p 75).

MANUFACTURERS ▶ **Steady growth of business**—this is the present outlook of electrical equipment manufacturers and related associations for 1958 (p 97).

COPPER ▶ **Violent tremors in copper prices may subside in '58.** Output-cuts presage a balance between supply and demand (p 91).

STOCKS ▶ **Electric utility common stocks held well last year,** actually rising while a 50-industrial-stock average fell 22% (p 94).

ADVERTISING ▶ **What makes an award-winning advertising department?** To answer this question, EW looks at Northern States Power Co—a collector of advertising trophies of various sorts since 1929. The company has won 75 awards, of which 27 have been first prizes. NSP's secret: Each ad must make its point clearly, briefly, and forcefully. All advertising encompasses one of two central themes—both of which extol electricity's economy (p 38).

SELLING ▶ **Kansas Power & Light pulled huge crowds to its booth** at a commercial fair by using such devices as a Reddy Kilowatt bingo, a mind-reading act, a demonstration of extrasensory perception, and "Housepower Roulette." Details on p 66.

PEOPLE ▶ **Westinghouse Electric Corp makes Gwilym A. Price** full-time chairman; Mark W. Cresap, Jr, president; E. V. Huggins, vice president; G. G. Main, vice president-finance; F. E. Dalton, controller; C. P. Myers, corporate secretary; R. B. Read, ass't treasurer (p 95) . . . Consumers Power Co names Alphonse H. Aymond, Jr, vice president in charge of legal, accounting, and gas matters . . . Dayton P&L makes Samuel J. Schiml and Edwin D. Smith vice presidents (p 96).

Electrical World's semi-annual index for July-December 1957 is now being prepared and will appear in a February issue.

Executive Reader

Insulating aluminum conductors by anodizing has entered a new field. Applied by a new process to the chassis of electronic equipment, it provides an abrasion-resistant insulation able to withstand as much as 20 kv. Yet its thermal conductivity is sufficient to dissipate the heat of power transistors and rectifiers mounted on the chassis.

Today's boilers need an ever-increasing number of soot-blower units. Their cost can add up to 5% of total boiler costs.

A brushless alternator with no moving parts except a solid metal rotor can be built in ratings up to 125 kva or more and can tolerate temperatures above 800F. Dc for excitation is taken from the ac output through self-contained rectifiers. The shaft speed is limited only by lubrication and centrifugal stresses in the solid-metal rotor.

Lowered electrical potential of the atmosphere resulting from atomic explosions is not permanent and is not likely to have an effect on weather. Nor will the present level of potential interfere with radio communications.

Varying the level of the moderator in a boiling-light-water nuclear reactor has been proposed as another method for the control of nuclear reactors.

Ordinary snapshots taken by engineers, are being used successfully to obtain design information, reduce drafting, and clarify instructions given to construction organizations.

Ultrasonic resonance testing of boiler tubes may cut boiler downtime by offering a simple, quick and reliable means of determining tube thickness. Instrument reading isn't affected by scale deposit on the inside of the tube.

FROM EDITORS IN THE FIELD

Not maintaining reclosers saves about $12,000 a year for a Southeastern utility. Failures averaged less than 3% during the last 10 years. Unless the failure rate increases above 5%, regular maintenance is not economical.

A single 22,000-bhp steam-driven boiler-feed pump will be used for each of the two 450-Mw supercritical pressure units to be installed by American Gas & Electric Co. In addition, each unit will have a 11,000-bhp motor-driven start-up pump and three low-pressure pumps.

Before you start that deadend, stop and re-consider. Let's look at a few facts. In 1946, the average residential use of electric power was 1,329 kwhr. In 1956, it was estimated at 2,980. Use had more than doubled in ten years.

What can you expect the next ten years to bring? Already the experts are forecasting 6000 kwhr annual consumption by 1965, 8000 by 1970. Past experience indicates the experts aren't so "expert." They usually estimate on the low side.

What's the point? You may have to increase the capacity of that line in five years, probably for sure in ten years. The easiest way to increase capacity is to raise voltage—provided you have the necessary insulation. As long as you're going up on the pole anyway, why not put in three insulators? It's a lot cheaper to do it now.

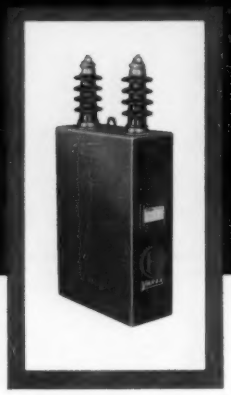
The insulators to use are O-B, of course.

Ohio Brass

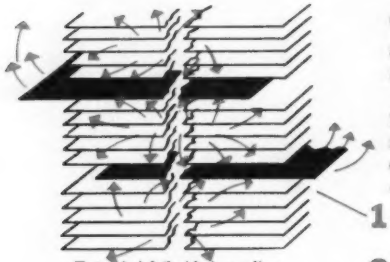
MANSFIELD OHIO, U. S. A.

CANADIAN OHIO BRASS CO., LTD.
NIAGARA FALLS, ONT.

BECAUSE THE FOIL EXTENDS HERE



VAREX users get



The extended foil design in Varex capacitor provides the aluminum foil with extra duties, beyond its conventional role as an electrode.

Varex foil helps in cooling, in reducing current densities, in simplifying the electrical contact system. In fact, you can see at least six basic advantages that can be attributed to the extended foil, advantages that contribute directly to longer capacitor life.

1—Extension of foil provides an unobstructed path for heat to flow from center to end of element.

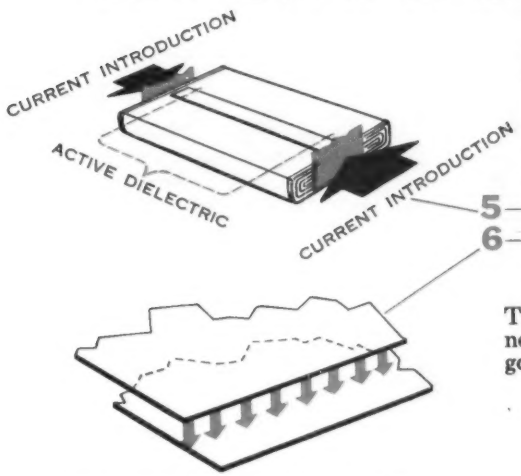
2—Extended foil makes possible a simple contact system whereby a contact plate can be pressed against the end of the element by springs . . . no welding, soldering or crimping.

3—With contact at two points on each turn of foil, the length of current path along the foil is short.

4—Current density on the foil is reduced since each contact feeds a shorter length of condenser surface. (The strip running across the bottom of this page represents one aluminum foil in a Varex element, drawn to scale and

4" — Orange indicates contact area between plate and foil

six extra benefits



Only stress is edge to plane, not edge to edge

partially unwound. Fully unwound a foil is approximately 900 inches long. The broken orange line indicates the portion of the foil edge which is contacted by the plate. More than half of the foil length is in contact with the plate. With so many contact areas, each area feeds only a short length of condenser surface.)

5—Current is introduced in an area outside the active dielectric.

6—Opportunity for concentrated electrical stress is reduced since stresses are always those of a foil edge to a foil plane. There are no edge-to-edge stresses.

The advantages of extended foil show that all capacitors are not alike. Only Varex has extended foil and the benefits that go with it.

Ohio Brass

Mystery: Why no O-B insulators in the three gunny sacks?

Scene: A power company warehouse in South Dakota.

Time: Midsummer 1956.

Cast: Safety engineer, linemen, Graybar salesman.

Action: Group assembled to discuss hot-line practices and treatment for shock resulting from handling defective materials. Among items on display were three gunny sacks full of insulators with pinhole cracks and other defects.

Question: How many brands of insulators were represented?

Answer: Several.

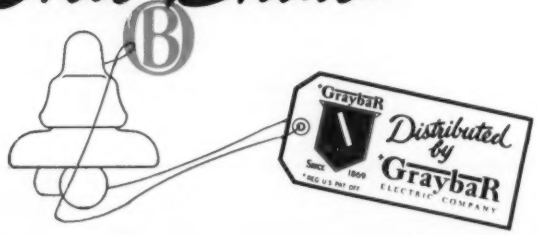
Question: How many O-B insulators were in the three bags?

Answer: Not one.

Solution: If you want insulators with proved lightning immunity on your distribution lines, always specify Ohio Brass insulators, available from your nearby Graybar warehouse.

OHIO BRASS COMPANY • MANSFIELD, OHIO

Ohio Brass



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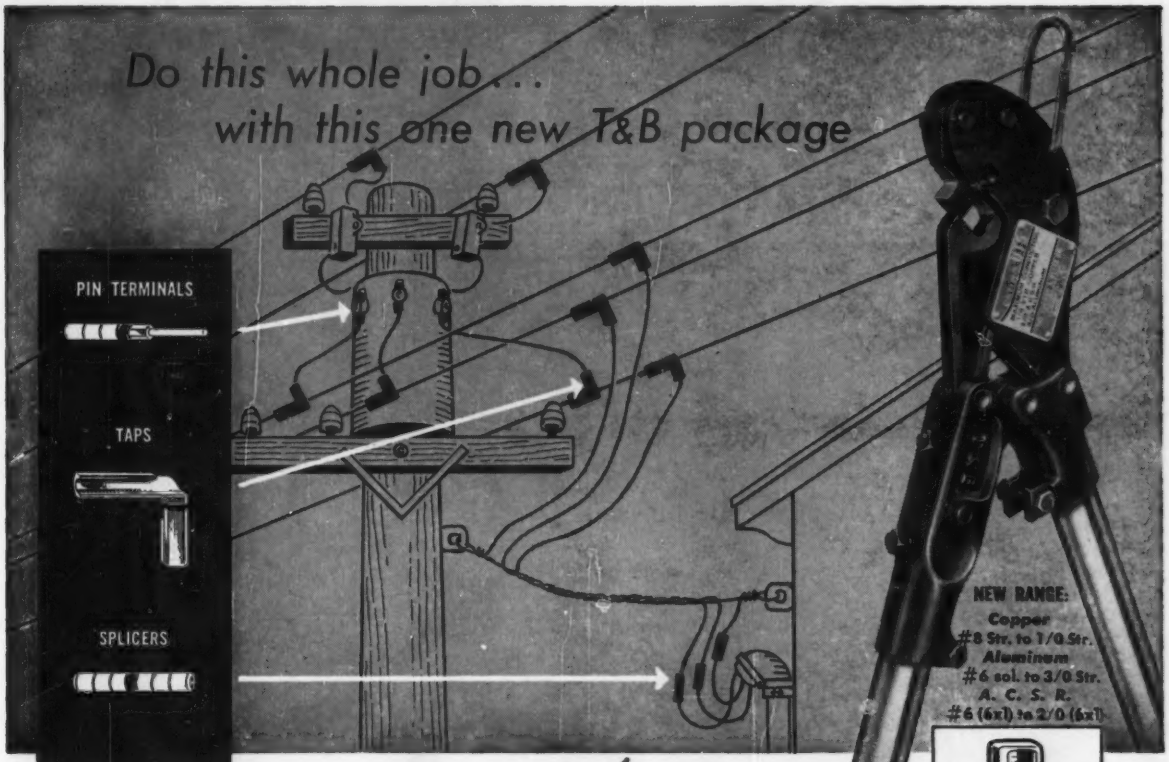


NEW!

T&B complete COLOR KEYED splicing package speeds line and service work

Now one new UT 5 installing tool is the *only* tool you need to make all line and service compression connections . . . including splicers, taps, and pin terminals. And T & B's color-keying insures accurate, speedy connections on a wide range of copper, aluminum and A. C. S. R. cable. Here's all you do . . . match the color of the die to the color of the connector . . . compress . . . and the joint is made.

Your T & B Distributor will be glad to demonstrate the UT 5 with its many advantages. When you use this one tool you simplify all your line and service work. For further information write for new T & B bulletin.

LOOK FOR THIS SIGN — T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T-61

THE THOMAS & BETTS CO.

INCORPORATED

14 Butler Street • Elizabeth 1, New Jersey
Thomas & Betts Ltd., Montreal, P.Q., Canada
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

DUAL VOLTAGE transformers

MEAN SAVINGS IN MONEY, TIME, LABOR

You save in stocking requirements . . . one unit can be stocked where it now takes two.

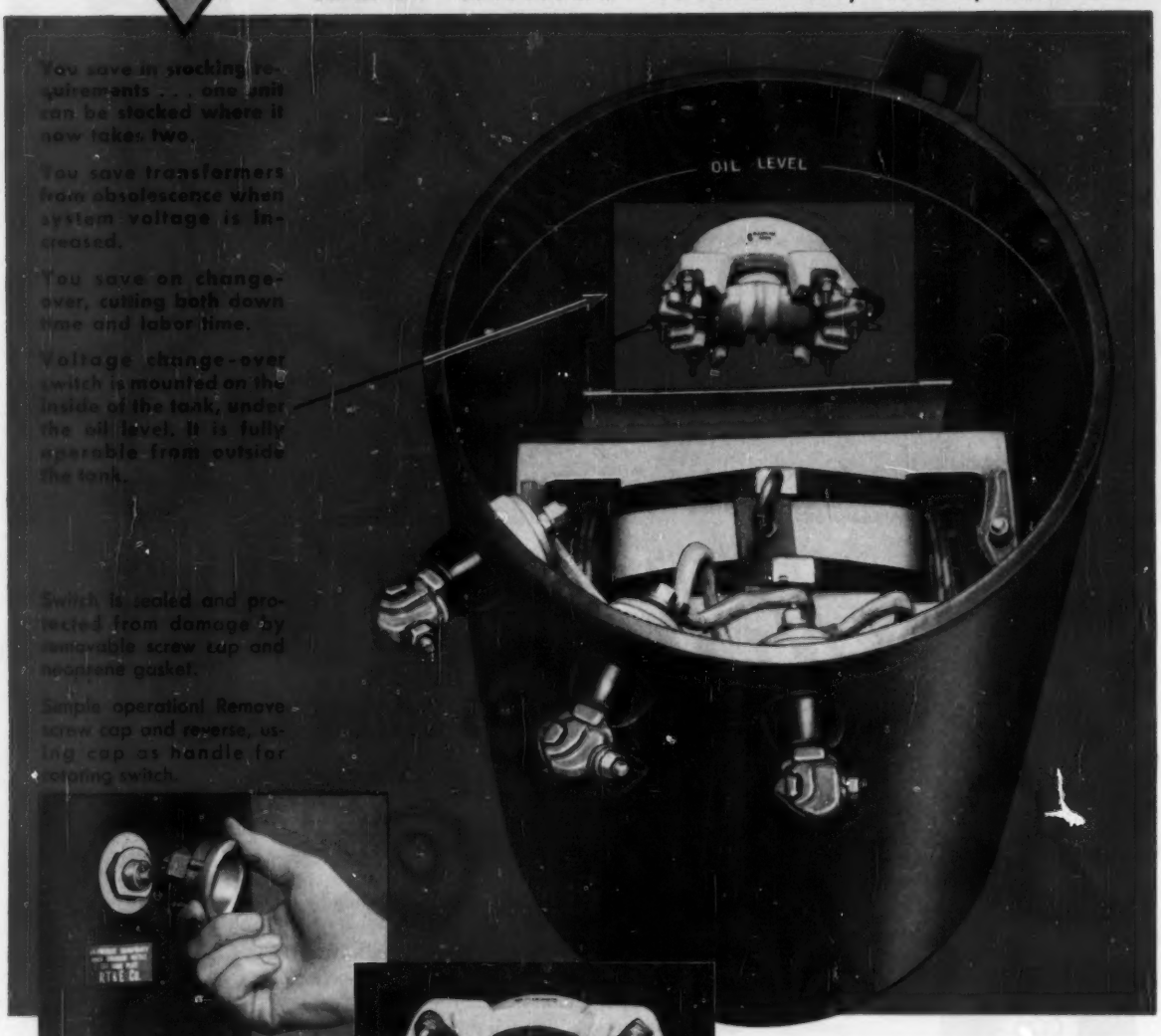
You save transformers from obsolescence when system voltage is increased.

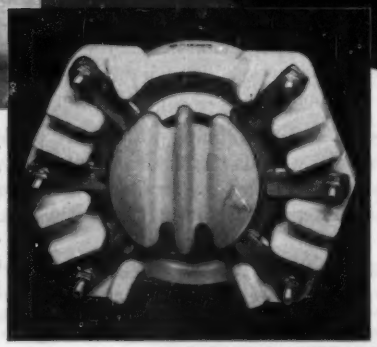
You save on change-over, cutting both down time and labor time.

Voltage change-over switch is mounted on the inside of the tank, under the oil level. It is fully operable from outside the tank.

Switch is sealed and protected from damage by removable screw cap and neoprene gasket.

Simple operation! Remove screw cap and reverse, using cap as handle for rotating switch.





Switch is rotary-bridging-to-position type, with both positions clearly identified by a stamped plate on the switch. Body constructed of wet process electrical porcelain with ample creepage. Fully impulse tested by NEMA standards.

For positive protection against puncture, flashover, or lightning failure the entire transformer is always insulated for the basic insulation level of the highest name plate voltage.

Available in	2400 x 4800 volt 2400 x 7200 volt 4800 x 14,400 volt 7200 x 14,400 volt	from 10 through 100 KVA.

Like all RTE Transformers, dual voltage models are backed by a five year guarantee. They are available from conveniently located warehouses throughout the U.S.

HELPING PROVIDE POWER FOR AMERICA

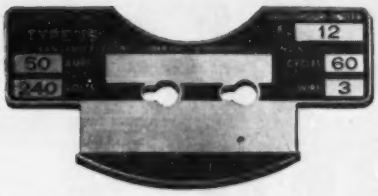
RT&E CORPORATION
WAUKESHA, WISCONSIN

Sangamo Class 200 Meters

PROVED by 17 years of performance

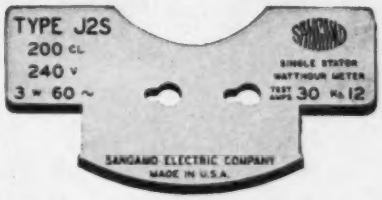
With singlephase residential loads growing... with more and more 200 ampere service entrance equipment being installed every day, attention is being drawn to Class 200 Singlephase Meters. Yet the development of 200 ampere meters is nothing new. Sangamo singlephase meters with accurate 200 ampere capacity have been in use for 17 years!

THE NAMEPLATES TELL THE STORY...



IN 1940, Sangamo introduced the Type J Meter which pioneered modern singlephase meter design. The 50 amp J Meter gave excellent curves up to loads of 200 amperes. These meters have been on power company lines for 17 years.

IN 1955, Sangamo presented the J2 Meter—the first standard extended range meter in the industry. The 50 amp J2 Meter offered straight line accuracy up to 200 amperes with only 18 starting watts. These 200 ampere capacity meters are on your lines today.



NOW Sangamo offers its Class 200, 30 ampere J2S Meter at the same price as Class 100 Meters—with proven accuracy to 200 amperes, slow disk speed, high starting torque, low starting watts. Choose this *proven* Class 200 Meter to protect your investment in metering.

NOW...THEY'RE GUARANTEED FOR LIFE!

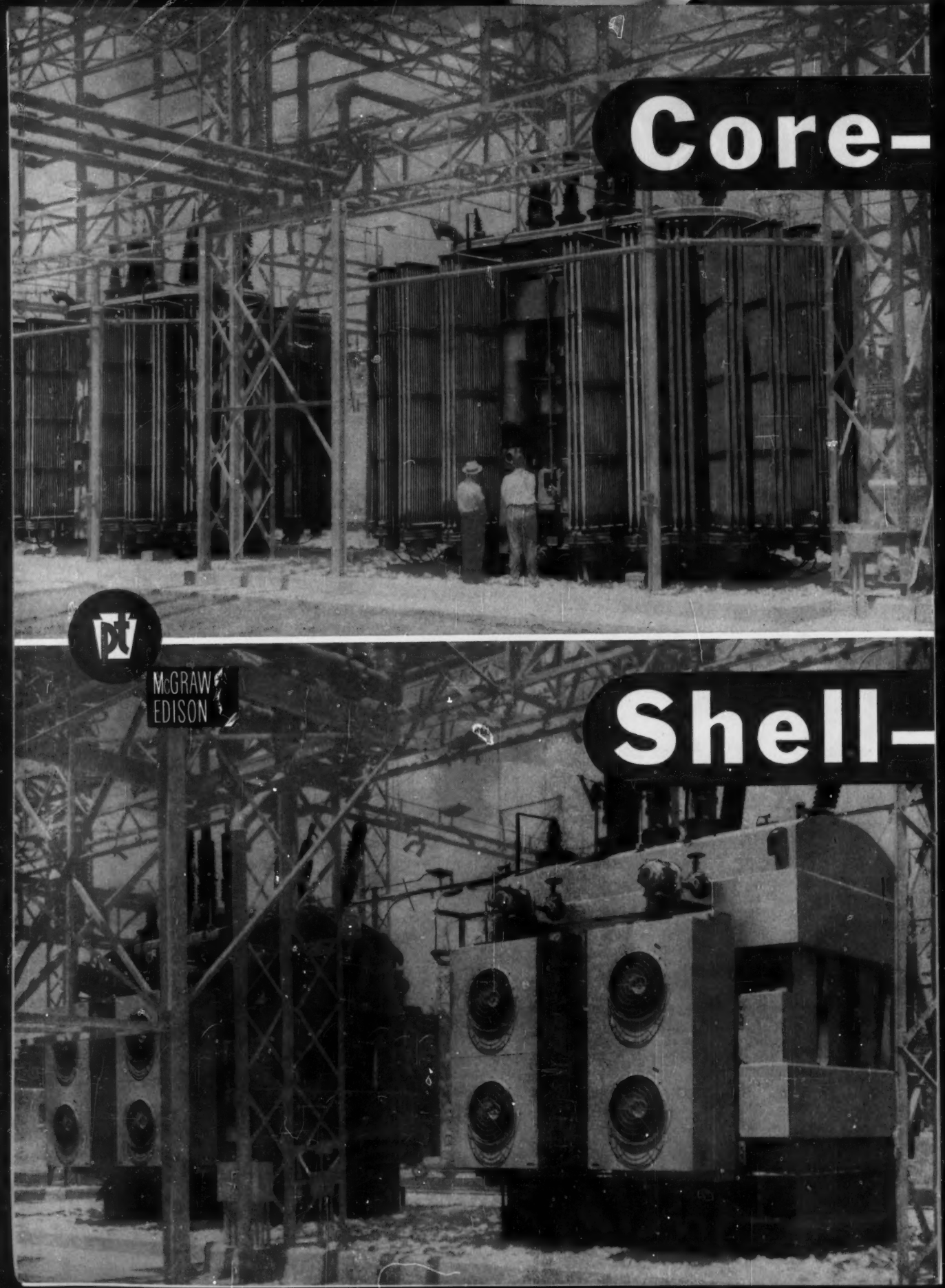
The electrical and mechanical stability of Sangamo Watthour Meters is so great that an unprecedented lifetime guarantee covering materials, workmanship and bearing systems—is offered on all new singlephase and polyphase meters using Sangamo's ball and jewel bearing system.

LIVE BETTER ELECTRICALLY

SANGAMO

ELECTRIC COMPANY *Springfield, Illinois*

JH57-10


Core-
McGRAW EDISON
Shell-

—form?

Pennsylvania builds both types of power transformers . . . choosing the best design for each application

Pennsylvania Transformer builds *both* core-form and shell-form power transformers because there are inherent advantages to be found in both designs. Whether core-form or shell-form design is best for a given kva and voltage in a particular application depends on such factors as size and weight . . . ease of installation . . . impedance . . . application of insulation . . . method of cooling, etc. In cases where there is no particular advantage to be found in either design, the purchaser's individual preference may prevail.

By taking advantage of Pennsylvania Transformer's wide experience in both core-form and shell-form design, you can be certain that every power transformer installed is the "right" transformer for that particular application. Contact Pennsylvania Transformer Division, McGraw-Edison Company, Box 330, Canonsburg, Pa.

—form?

350,000 kva Pennsylvania transformer installation includes both core-form and shell-form Generating Station Units

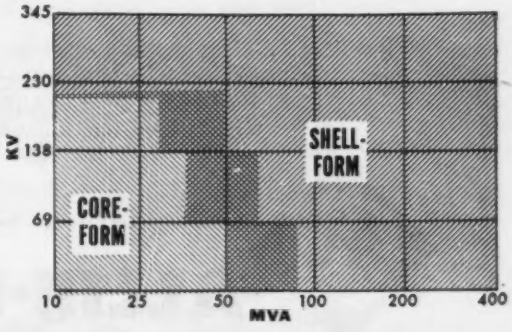
The pictured installation of main generating station transformers effectively illustrates Pennsylvania Transformer's versatility in the field of power transformer design. Both the core-form units, above, and the shell-form units are located at the same generating station, where they perform step-up service for two different generators.

The two core-form units are each rated at 56,000 kva when self-cooled, and at 70,000 kva when the forced-air cooling is in operation. Connected to a 110,000-kw generator, they step up a generated voltage of 15 kv to 132 kv.

The two shell form units are each rated at 105,000 kva, using forced-oil-to-air heat exchangers. Connected to a 156,000-kw generator, they step up a generated voltage of 19 kv to 132 kv.

Core-form or shell-form? Why not let the answer for your next transformer be based on Pennsylvania's proved principles of power transformer design?

TYPICAL APPLICATIONS OF CORE-FORM AND SHELL-FORM DESIGNS

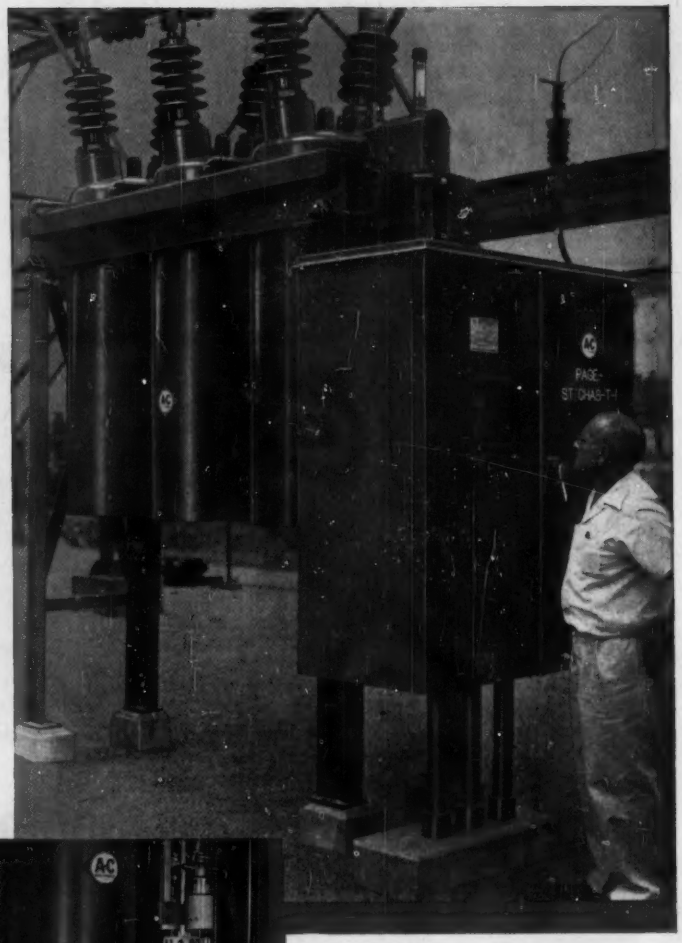


PENNSYLVANIA POWER TRANSFORMERS

ALLIS-CHALMERS

"F Z O" frame-type breaker

Has 3 Features You Want Most!



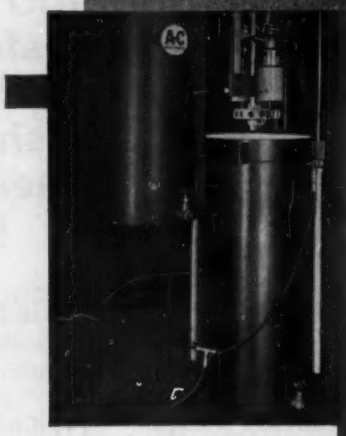
HERE are the outstanding features utilities enjoy with this Allis-Chalmers frame-type breaker.

Pneu-Draulic **operator provides last word in simplicity — ease of inspection — reliability.**

Power-operated hydraulic tank lifter takes all the effort out of raising and lowering tanks — saves time.

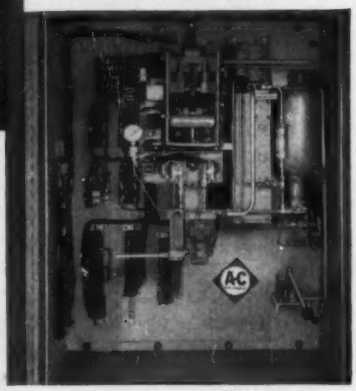
Turbo-Ruptor **interrupting device with self-aligning tulip and bayonet contacts.**

In addition, there are dozens of refinements, such as the side trip . . . new oil sampling device . . . float-type oil gauge . . . external adjustment of overtravel stop . . . ASA standard bushings . . . which make this the finest breaker in the field.



Power-operated hydraulic tank lifter.

Pneu-Draulic operator.



For complete details, call your nearby Allis-Chalmers office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Pneu-Draulic and *Turbo-Ruptor* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

A-5417

BELL TELEPHONE LABORATORIES DEVELOPS NEW COMPACT COMPUTER FOR U. S. AIR FORCE

J. A. Githens, B.S. in E.E., Drexel Institute of Technology, and J. A. Baird, Ph.D. in E.E., Texas A. & M., check the control panel of Leprechaun, a new high-speed computer which solves extremely complex problems in one-tenth of a second. Small size and low power are made possible by new design principles and Bell Laboratories' invention of the transistor.

The United States Air Force assigned Bell Labs an interesting assignment: develop a new kind of electronic computer. The major requirement was greater simplicity. Of course, no computer is simple, but this one (known as "Leprechaun" to its designers) is much smaller and simpler than most of the computers currently in use.

It has only some 9000 electrical components; 5000 of them are transistors. As a result, Leprechaun has less than one-third the components of conventional computers. This facilitates testing, experimentation, assembly and service.

Even in its experimental state, Leprechaun is a stimulating example of great strides in the simplification and miniaturization of circuitry . . . a problem of profound interest to all Bell Laboratories researchers as they develop radically new equipment for your future telephone service.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

Another new development using

B.F.Goodrich Chemical *raw materials*

The new Convair 880 jet passenger liner uses wiring made by many of the leading wire and cable companies. B.F.Goodrich Chemical Company supplies the Geon polyvinyl material only.

15 MILES OF GEON HELP JET-LINER BEAT THE HEAT

MOVING East to West just a step behind the sun, this new jet passenger liner will make it from New York to Los Angeles in 4 hours 32 minutes. Hard at work inside this plane of tomorrow will be wire whose 15 miles of tough insulation is made of a unique new Geon polyvinyl compound.

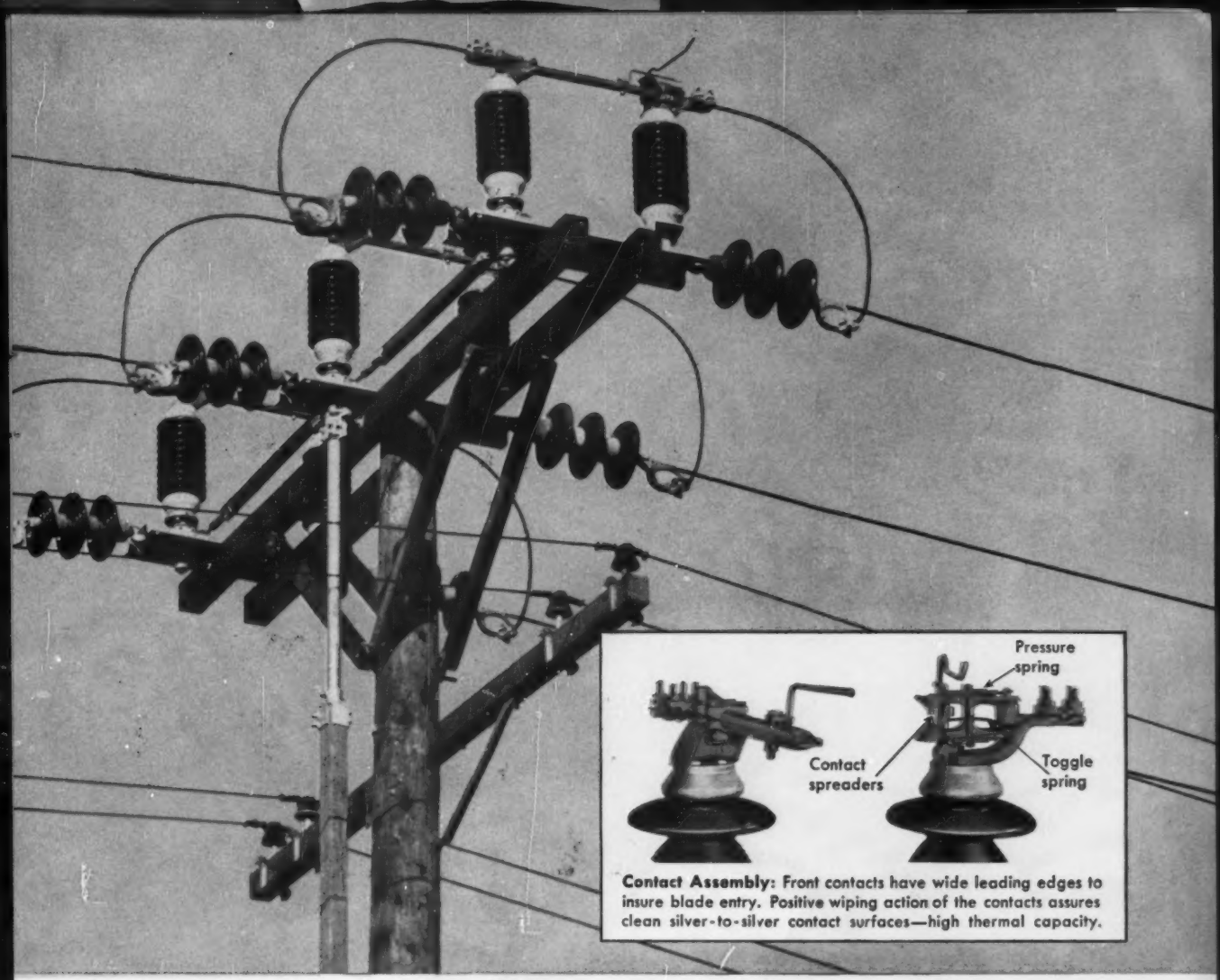
Why Geon Was Chosen—Geon 8800 compound has *5 times* the insulation resistance of previously available insulations over the full operating temperature range. The exceptional heat stability of Geon 8800 provides the superior performance required for jet aircraft wiring. These properties offer advantages as well for appliances, computers, machine wiring and similar applications.

How We Can Help You—Versatile Geon polyvinyl materials, in addition to providing flexible electrical insulation, are used for rigid piping and valves, protective coatings for steel, paper, upholstery. B.F.Goodrich Chemical supplies hundreds of types of resins, plastics, latices, and polyblends tailored to specific uses.

For information on applications write Dept. LR-1, B.F.Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich **GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors**



Contact Assembly: Front contacts have wide leading edges to insure blade entry. Positive wiping action of the contacts assures clean silver-to-silver contact surfaces—high thermal capacity.

L-M's New Side-Break Switch Is Rugged, Reliable and Easy To Operate

Line Material has designed a new, rugged side-break switch which has all the desirable operating features of a dependable switch for both line and substation sectionalizing.

Only six current transfer points with high-pressure silver-to-silver contacts and heavy back-up mass provide high thermal capacity for continuous or short-time fault currents. Straight-line current path minimizes short circuit forces tending to open switch. Minimum frictional drag at rotating terminal is achieved by current transfer on center of rotation. Rugged full-floating contacts swivel to give smooth, easy operation, positive wiping motion, and definite ice-breaking action.

Positive Toggle Action

Wide-angle leading edges on front contacts insure blade entry regardless of alignment, with no loss of contact pressure. Contact-positioning spring has positive toggle action to hold the contacts in the open position (45° from switch centerline) or firmly in the closed position. Ease of operation and long contact life result, because contact spreaders preload pressure springs for minimum contact movement during blade entry. Wide-spaced contact jaws and clearance around moving parts facilitate positive switch action under severe ice or corrosion conditions.

Silicone-Lubricated for Life

All bearings and moving joints on the switch are silicone-greased—lubricated for life, and positively sealed with silicone cord rings. Water, dust or dirt cannot enter to affect bearing operation.

Get Complete Information

L-M's new side-break switch is available in 600 amperes, 7.5 to 69 kv as a single-pole, or up to a six-pole unit. Ask your L-M Field Engineer for information and bulletins on L-M's Power Switching Equipment. Or write Line Material Industries, Milwaukee 1, Wisconsin.

McGRAW EDISON

LINE MATERIAL Industries

McGRAW-EDISON COMPANY

Power Switching Equipment

302

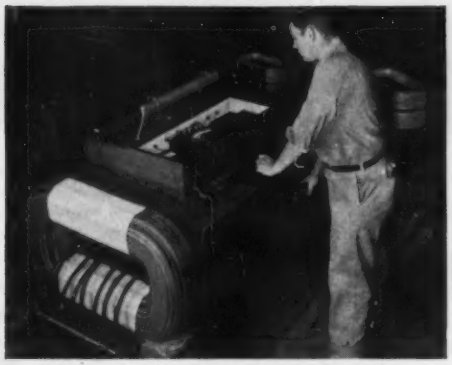
EACH LINE MATERIAL TRANSFORMER is issued an IBM card upon which are placed all test results and reference information pertinent to the unit. Cards are microfilmed as a permanent record.

How L-M's Quality-Control System Insures High Transformer Standards

By **ROBERT P. THOMPSON**
Manager of Engineering
Transformers
Line Material Industries

Performance characteristics of L-M Round-Wound® transformers are outstanding. Physical features are exceptional. Quality is *built in* to L-M transformers, not tested in. To make doubly sure of maintaining uniformly high quality, L-M has established a very tight quality-control system.

Continuous tests are made—from raw materials to finished product. A final assurance of quality is the permanent microfilmed record of test information kept on every L-M transformer.



CORE TESTING: The tolerance permitted in testing the bare core of L-M's Round-Wound transformer is much more stringent than required by NEMA and ASA of core performance in the completed transformer.

The specially trained craftsmen who make Round-Wound transformers take pride in the high quality of their work—no small contribution to the continued excellence of Round-Wound transformers and their amazingly low failure rate—less than 2/10 of 1 percent!

Check on Incoming Materials

All raw materials and parts for L-M Round-Wound transformers are rigidly and systematically inspected. For example:

- Every high-voltage porcelain bushing is subjected to acceptance dielectric tests.
- Samples of all wire are tested for resistance and cross-section uniformity; coating is tested for dielectric strength, adherence, thickness.
- The cold-rolled oriented silicon steel used in making L-M's wound core is tested for physical and magnetic characteristics by means of a precision Epstein tester. Rigid standards on the loss and permeability characteristics are maintained.

In-Process Tests

A continuous "in-process" testing and inspection program is followed throughout the plant. Cores are tested for magnetic characteristics before and after copper coils are wound upon them. Coils are checked for ratio and given a mechanical inspection immediately after being wound. All finished units are thoroughly tested for leaks.

COIL RATIO TEST: Ratio and polarity are checked immediately after the coil is wound, so as to maintain close surveillance of the coil-winding operation at all times.

When the unit is completed, every transformer is given a complete series of electrical tests in strict conformity with NEMA and ASA standards. These tests include core loss and excitation current, copper loss and impedance, ratio, induced voltage, high potential, polarity, and impulse.

Certificate of Test

Each transformer is issued an IBM card which follows the unit through to completion. The card provides space for all test results. It is punched or filled in at each inspection and test station if, *and only if*, the transformer satisfactorily meets all the requirements of NEMA standards and of the L-M engineering and quality-control departments.

When the transformer is shipped, the cards are microfilmed and then stored to provide actual test data throughout the life of the transformer. This complete test information can be furnished to you at any time on any transformer.

Compare L-M's high standards of performance and outstanding physical features with other transformers; you will see why more customers are specifying L-M Round-Wound transformers.

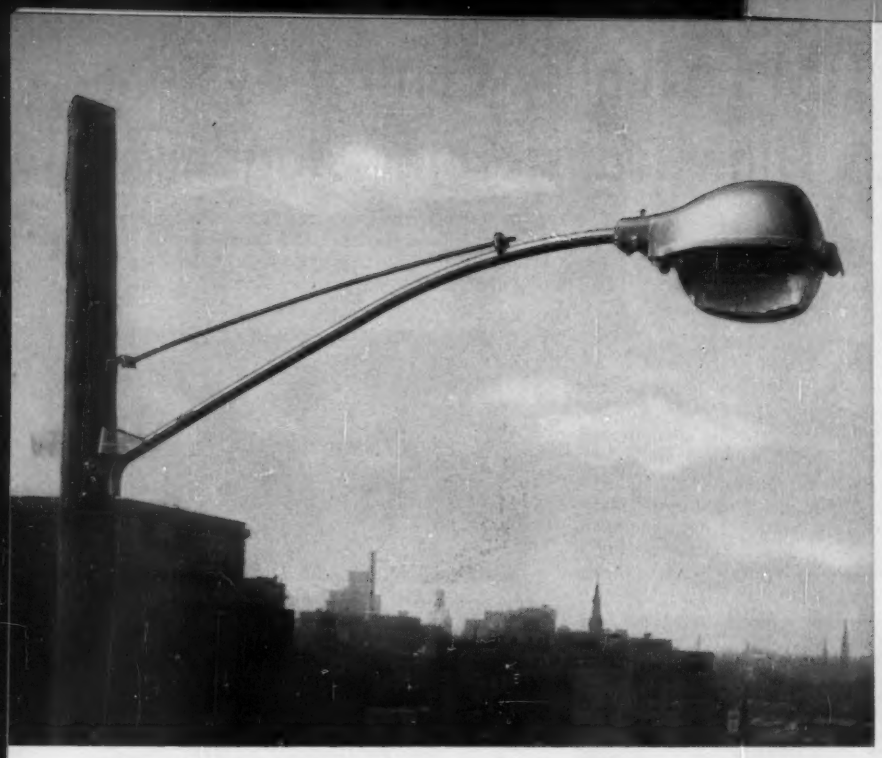
Get Complete Information

Ask your L-M Field Engineer for complete information on the outstanding performance characteristics of L-M Round-Wound transformers and on L-M's unique obround tank. Or write Line Material Industries, Milwaukee 1, Wisconsin.

LINE MATERIAL Industries
McGRAW-EDISON COMPANY

Transformers

McGRAW EDISON



Guy rod, pipe and parts are all firmly packaged together. Storeroom space has been reduced considerably because it is no longer necessary to have a separate bin for each part.

Why L-M Luminaire Supports Are Easy To Handle, Easy To Store

L-M's complete line of steel or aluminum luminaire supports is shipped packaged, with guy rod, pipe and parts firmly strapped together. All threaded parts of each support are protected with a plastic coating. The pole fitting and brace support are welded to the bracket, which reduces the number of parts.

How Packaging Saves Time and Storeroom Space

Because all parts for L-M's luminaire support are packaged together, they can be stored as a unit, eliminating separate bins for each part. Parts are not lost in shipment or in the storeroom when packaged together. The correct components will always be sent to the job site.

L-M's luminaire supports are designed for—

Appearance: L-M provides four harmonizing styles of supports so that several types can be used in the same installation, if desired. The supports are "upsweep" in design to give a handsome appearance.

Strength: Completely wind-tunnel-tested, L-M's luminaire supports are designed to withstand winds up to 150 M.P.H., to assure generous lateral strength. The supports can also withstand heavy non-sustaining vertical loads up to 250 pounds without collapse or rupture. The pole fitting and brace support are welded to the bracket to insure ample strength and minimize vibration.

Meet Proposed EEI-NEMA Standards: L-M supports meet the new proposed EEI-NEMA standards for strength and minimum pole mounting requirements. The minimum pole space advantage makes these supports particularly desirable for joint-use poles.

Complete Line of Luminaires and Supports

L-M supports are available in lengths up to 20 feet, in steel or aluminum. L-M also offers a full line of street lighting luminaires—incandescent, mercury vapor, and fluorescent—and complete street lighting application engineering service. Ask the L-M Field Engineer for information and bulletins. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

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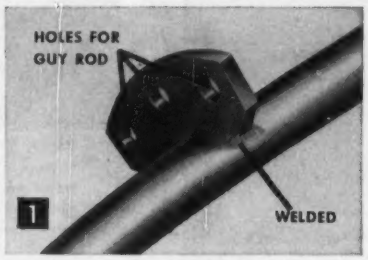
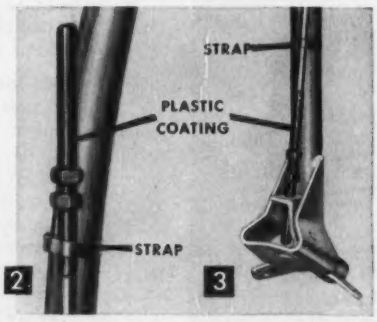


Support for guy rods is welded to the bracket. This reduces the number of parts, adds strength to the bracket, and minimizes vibration.



Nuts and threaded parts are covered with a plastic protective coating. Brace is firmly strapped to the bracket to facilitate shipping, handling, and storage.

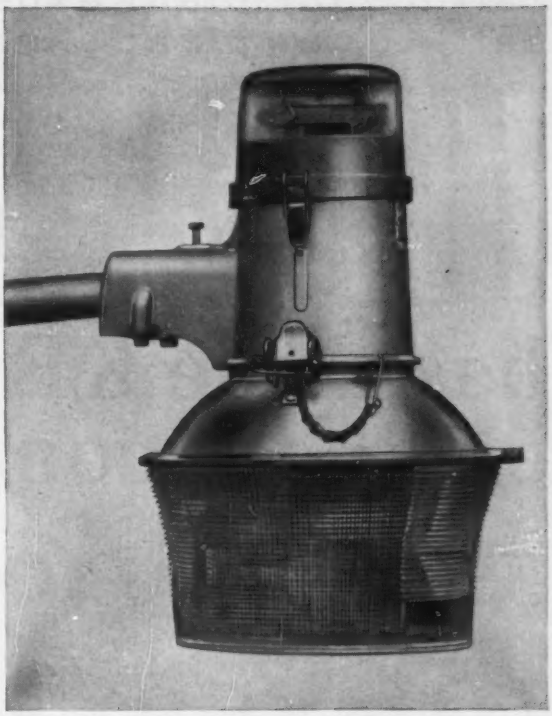
4 Each L-M luminaire support is identified with an easy-to-read label which lists the catalog number and illustrates the mounting, length, and rise dimensions.

When ordering lighting equipment, protect yourself. Insist on quality products that meet the exacting requirements of EEI-NEMA standards (Edison Electric Institute and National Electrical Manufacturers Association).

LINE MATERIAL
McGRAW-EDISON COMPANY
Street Lighting

L-M Suburbanaire Gives Protection, Adds Off-Peak Load

Utilities rent customers this photocell-controlled luminaire at about $3 a month; it provides all-night lighting for security and recreation; increases revenue for the utility. Open-type refractor keeps maintenance at minimum.



A number of utility companies have had excellent results with a new plan for individual outdoor lighting for customers. Here, briefly, is the plan:

- The utility installs the L-M Suburbanaire on the customer's premises without charge. The Suburbanaire is an open-type, low-cost luminaire with built-in photocell control, thus providing all-night yard lighting.
- The utility maintains the unit and keeps it in operation.
- The utility provides power which does not go through the customer's meter.
- Cost to the customer is a stated amount per month—usually $3 or $3.50—which covers all costs. The utility retains ownership of the luminaire.

Customers like the plan, because it safeguards property, cuts vandalism and theft, reduces accidents, and has some prestige value, particularly in areas where there is no street lighting.

From the utility standpoint, the plan increases revenue in off-peak hours. Here is what some utility men say:

"We have installed more than 200 L-M rural lights, increased our off-peak load by more than 50 kw, and have had many expressions of complete satisfaction from our customers."

"The Photocell Suburbanaire assures us of an off-peak load of about 1000 kw hours per unit. We have installed almost 400 Suburbanaire luminaires, many of these replacing the old makeshift radial fixture arrangement. Customer reaction has been excellent . . . equipment and gasoline theft has dropped substantially and vandalism is almost nil."

"From time to time, customers have asked us for outdoor lighting for rural and suburban homes. Since January, 1957, we have been installing L-M's new Suburbanaire unit. The long-life lamp and photo-electric cell, plus ease in relamping and cleaning the open refractor, will keep our maintenance costs at a very low minimum. This makes it possible to offer this service at a very low cost."

TYPICAL ANALYSIS OF COSTS

Material:	
Suburbanaire, photocell, bracket, etc.	$ 70.00
Installation labor	30.00
Annual power cost (based on 300 watt lamp burning 4000 hrs. per year @ 1¢ kwh)	12.00
Lamp replacement, maintenance	9.00
Total Cost First Year	**$ 121.00**
Outdoor lighting equipment is built to last 20 to 25 years, but if this equipment is amortized over 10 years, the cost will be:	
First-year cost (above)	$121.00
Nine times power and maintenance cost (9 more years)	
9 x ($12 + $9)	189.00
10-year total	$310.00
Interest at 6%	18.60
Profit, at 10% on $328.60	32.86
Total 10-Year Cost Plus Profit	**$ 361.46**
Annual cost (1/10th)	$ 36.15
Cost per month (1/12th)	$ 3.01

Get The Whole Story

Ask the L-M Field Engineer for bulletin on the L-M Suburbanaire luminaire and more information on the profitable customer-rental plan. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

McGRAW EDISON

316

LINE MATERIAL Industries Outdoor Lighting

McGRAW-EDISON COMPANY

call KE for plant expansion or new facilities

call KE for plant expansion or new facilities

INGENUITY

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4381

- One single instrument with internal limit switches for limiting the range of operation.
- Positive assurance that limits are set on one of the designated operating points.
- Equipment need not be de-energized to adjust the limit levels.
- Raise and lower limits may be set independently.

LOAD RANGE SELECTOR

Supplied on Westinghouse single-phase, type URL and URF, feeder voltage regulators; on all standard three-phase type URS voltage regulators rated 750-kva and below.

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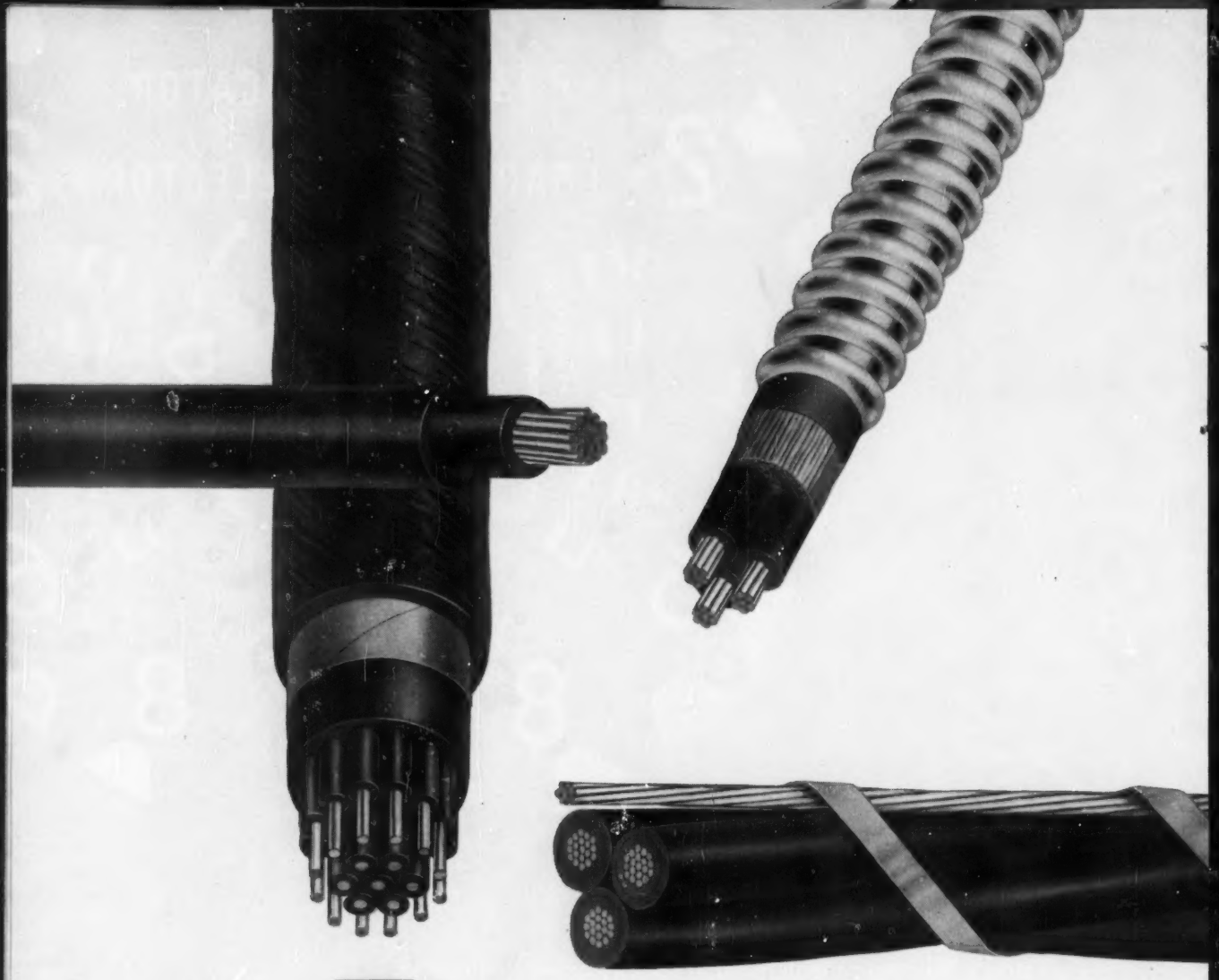
YOU CAN BE SURE... IF IT'S Westinghouse



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—Kerite's the answer. For Kerite's wide range of cable types combines the latest techniques, materials and engineering with an insulation that is unsurpassed in its proven ability to serve reliably for years under the trying conditions of actual operation. Leading engineers will confirm this. We, too, would be pleased to tell you more.

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KERITE CABLE

QUALIFIED TO PRODUCT P I I MEMBER

it's the **KERITE** *that makes the difference*

Editorial Comment

JANUARY 6, 1958

More Ways to Save Your Reading Time

"I don't have time to read all of the things that come over my desk" . . . "I need someone to do my reading for me" . . . "There are too many magazines as it is."

These are a few typical comments coming from the readers of Electrical World, but by and large they are typical thoughts of most of us. In view of this unhappy situation in which we all find ourselves, Electrical World has dedicated itself to doing something about it.

The editors of Electrical World have been trying hard to do your reading for you. We listen to, read and condense every significant paper presented at every significant meeting in the industry which totals in the neighborhood of 100 meetings and over a thousand papers. We read all industry publications, both domestic and foreign, in search of ideas and editorial material. Each day we work through 150 releases and proposed articles selecting the ones of most significance for publication in Electrical World. During this same day we talk to an average of 30 or 40 industry representatives. Even with this vast amount of research we would not claim to pick up everything that you wish to know but we are reporting 90% of the things you want to know in the 8,000 items carried annually.

Last year we inaugurated two 4-page special stock inserts in which you find the latest developments condensed for easy reading. In addition, we give you a two-minute summary of the issue for quick reading and as a means of locating the things you wish to read first. Each of the technical news or management articles are condensed to an absolute minimum and every effort is made to carry the most significant points in the head, the summary, and the first couple of paragraphs. Each illustration is designed to give a complete idea in itself.

In 1958 we are expanding this service in the way of doing your reading for you. On the 4th page of the Electrical Newsletter, the yellow insert in the front of the book, we present a new service entitled "Executive Reader". On this page we will call to your attention articles from other publications giving you the pertinent facts and the significant conclusions.

There are many other new and improved services introduced in this and the next issue. To list a few, you will find the major editorial pages perforated for easy removal, more color in our illustrations for easier reading, and a special 4-page report on the Business Outlook which will be the feature of the second issue of each month in the Management Newsletter. The same Management Newsletter will carry in rotation the most significant developments in financial news, rates, regulation, public relations, advertising and industrial relations, and as in the past, material on rights-of-ways, safety, and reading material not carried in other sections of the magazine.

We hope that you will enjoy these new services, and will continue to tell us what kind of magazine you want Electrical World to be.

A New Session: What's Ahead?

- As Congress reconvenes this week, the Big Three topics are TVA bond financing, atomic power, Trinity River Dam
- But traditional positions on these power questions may be complicated by newly important problems of defense spending

The second session of the 85th Congress begins this week in an atmosphere promising to influence traditional positions on a number of issues involving electric power.

Greater defense spending, the need to economize on non-defense matters, and lengthy arguments over what is and is not essential civilian spending, all will have an effect on power legislation.

TVA: Top Topic for '58

Congress' leading item of unfinished business in the power field is the question of how Tennessee Valley Authority's future power needs are to be financed.

Atomic energy, as in the past few years, will figure prominently.

The question of partnership development at Trinity River Dam in California may come to a head. This is an explosive issue which will influence the upcoming elections.

In addition, there are certain to be a number of lesser items.

TVA: Senate last year passed the Kerr bill giving TVA authority to finance future power additions out of revenue bonds to the extent of $750 million. Awaiting House action this year is the Davis bill which authorizes TVA to issue an unlimited amount in bonds.

While the Kerr bill places some restrictions on TVA territorial expansion and puts a ceiling on the amount of bonds, the Davis bill does neither.

Electric utility industry is opposed to both. Fight will come in the House where the industry can count on greater support than in the Senate.

A-Power: How Much, By Whom?

Atomic energy: The issue this year, as in past years, will be whether atomic power development should be accelerated and if so, whether the government or industry should do the job.

The case this year for those—the Democrats—who argue that acceleration is needed, and that the government should build atomic power plants to achieve this, is stronger than in past years.

Recent disclosures have shown these plant costs are much higher than first anticipated. These disclosures are expected to slow down the projected rate of development, especially of amount of kilowatts of installed capacity. On top of this has come Soviet advances in science.

What it adds up to is an argument that the U.S. must step up A-power development to keep ahead of Russia and maintain world leadership.

In this context, Sen Albert Gore (D-Tenn.), Reps Chet Holifield (D-Calif.), and Melvin Price (D-Ill.) have jointly drafted a bill proposing a stepped-up program of atomic power development.

Details have not been disclosed but it is expected to call for federal construction of power reactors on a scale larger than the old Gore bill which proposed $400 million of federal construction.

The course of A-power plant legislation this year will hinge largely on the success of efforts to get Joint Committee on Atomic Energy and Atomic Energy Commission together on a common policy.

Hanging over the whole atomic power picture is the fact that Congress may decide that atomic energy money could be better spent in stepping up nuclear defense development and that atomic power will have to carry on the same basis as the past year with whatever funds are available.

Trinity: Partnership Tangle

Trinity River Dam: Interior Secy Fred Seaton has proposed to Congress that Pacific Gas & Electric Co install and operate the $225-million, 384,000-kw dam and buy falling water from the government.

Rep Hubert Scudder (R-Calif.) introduced legislation to authorize Seaton's proposal last year. The bill remained in the House Interior and Insular Affairs Committee whose chairman, Rep Clair Engle (D-Calif.) opposes it.

Trinity now is under construction and a decision will have to be made soon on the power facilities. If Seaton's plan is turned down, Congress will have to vote money for the facilities.

Democrats, backed by federal power supporting organizations, are firmly against the partnership idea at Trinity. They charge it will violate the preference law. But there is strong support for partnership from California because of the taxes that will be paid by PG&E.

Engle, leading the opposition to partnership, claims Trinity will be a major issue in the coming election. He will campaign on it in running for the Senate in California.

Utility Group Slates Advanced Reactor

New $50-million program proposed by two utility groups suggests:

- **Construction of 50-Mw reactor, a prototype of 200-Mw facility**
- **Partnership with AEC in research and development expenses**

Two groups of private utilities have proposed to the Atomic Energy Commission the development of an advanced nuclear power reactor.

The proposal includes a research and development program on a partnership basis with the AEC, and the construction of a 50-Mw prototype reactor.

The reactor will be a high temperature, gas-cooled, heavy water-moderated reactor of the pressure-tube type operating on natural uranium. It would be the prototype of a 200-Mw reactor and would go into operation within five years.

The two utilities groups involved are the East-Central Nuclear Group (EW, March 4, 1957, p 50) and a two-company Florida West Coast Nuclear Group. (The latter is composed of Florida Power Corp and Tampa Electric Co).

Total Cost Set at $50 Million

Estimated total cost of the entire program is about $50 million. Of this amount, construction of the power plant is estimated at $25.9 million, while pre- and post-operational research and development and other allied expenses is estimated to cost $24.3 million. The AEC is being asked to contribute about half of the cost of the R&D and other allied expenses.

Steam Conditions Improve

By using advanced fuel technology, steam conditions comparable with those in modern conventional power plants can be attained. The steam conditions will be 1,000F at 1,000 to 1,800 psi. Exit coolant gas temperature will be 1,020F at 520 psia. Ceramic instead of metal fuel will be used because of the high coolant temperature. The fuel jacket will be stainless steel.

The normal reactor pressure shell will be replaced with pressure tubes to withstand the high coolant pressure better (Calder Hall gas-cooled reactor has a pressure of 100 psi). Another objective of this design is to confine radioactive fission products to the nuclear fuel elements themselves.

Gain in Capital Costs Seen

This design should gain in capital costs over the Calder Hall type with the fuel cycle retaining the low cost benefits. A target of the proposed program is a specific power of 11.2 Mw per ton. This is many times Calder Hall's specific power and would be a major breakthrough in reactor technology.

The proposal calls for ECNG to undertake the research and development phase of the program, with AEC assistance, and for the FWCNG to undertake the construction and operation of the prototype on the systems of the Florida companies. But the proposal does not commit the power groups to build the 200-Mw plant.

General Nuclear Engineering Corp will be principal design agent for the R&D program. American Gas & Electric Service Corp will be principal design and construction engineers for the project.

The new proposal replaced one by the Florida Nuclear Power Group (the two companies in FWCNG and Florida Power & Light Co) for a heavy water-moderated, gas-cooled, natural uranium fueled reactor of 136 Mw capacity. AEC rejected the original proposal because it could not reach agreement with the participating companies on financial assistance.

The proposal places AEC in a tricky situation in view of the possible completion date of 1963. Under AEC's third round invitation to companies to make such proposal, it was specified that all proposals must call for completion by June 30, 1962.

AEC May Seek Exception

If AEC accepts this new proposal it may have to find some way around the restrictions it has imposed in the third round.

The ECNG companies are: Appalachian Electric Power Co, Indiana & Michigan Electric Co, and Ohio Power Co (represented by their service organization, American Gas & Electric Service Corp); The Cleveland Electric Illuminating Co; Columbus & Southern Ohio Electric Co; Dayton Power & Light Co; Indianapolis Power & Light Co; Louisville Gas & Electric Co; Ohio Edison Co and Pennsylvania Power Co; Southern Indiana Gas & Electric Co; and Monongahela Power Co, Potomac Edison Co and West Penn Power Co (members of The West Penn Electric System).

Research and Development Aims

1. Development of pressure tube with over 15 year life and low neutron absorption for this service.
2. Satisfactory reactor design using pressure tubes.
3. Beryllium fuel jacket to withstand coolant gas temperature of 1,070F. Use of beryllium will facilitate a large natural uranium reactor and allow a maximum fuel temperature of 2,900F.

Northern States' Donley and Furber qualify to answer the question . . .

What Makes an Ad Department

Winning prizes for advertising has become a habit at Northern States Power Co.

Last year the NSP advertising department carried off seven awards from the Public Utilities Advertising Assn's annual competition. It was the largest number of awards won by any utility in the contest—which drew more than 2,000 entries from the United States and Canada.

But it was no surprise. Northern States Power Co, a utility serving more than 500 communities in Minnesota, Wisconsin, and the Dakotas, has been bagging trophies in ad contests since 1929.

Since then the company has received more than 75 awards for advertising of all kinds—and 27 of them have been first prizes.

NSP has won awards for posters and billboards, direct-mail campaigns and movies, bill enclosures and booklets, newspaper ads and TV commercials—even for window decorations. Since 1929 not a year has passed without the Northern States ad department's adding at least one trophy to its collection.

How is it done? The men responsible for the feat say they use no gimmicks or special stunts.

Like other well run utilities, NSP recognizes that its first responsibility is to provide adequate and dependable service to its customers. With this as its constant goal, the company feels free to extol the virtues of its service and explain the unlimited uses of its product.

In doing this, the advertising department holds its ads up against certain minimum standards. Each ad must make its point clearly, briefly and forcefully.

Kwhrs Are "Penny Cheap"

There are a couple of central themes woven into all NSP advertising. Both emphasize the low cost of electricity.

The first recurrent theme simply states that "electricity is penny cheap." Variations on the theme of what a penny will buy in electricity have been a standard part of NSP advertising for nearly 30 years. The company's logotype signature still carries the message: "Electricity is penny cheap from NSP."

Another idea first used by Northern States, and now widely adopted by other utilities, is a comparison of electric rate trends with cost-of-living trends. With charts, graphs, and copy, NSP hammers home to customers that "in the last 25 years average rates for residential and rural electricity have decreased 50% while the cost of living has gone up 100% and more."

Simple use of good basic ideas is an NSP strongpoint. Advertisements in all media present a "united front." These two themes, with variations, are plugged simultaneously in newspapers, on radio and television, and through direct-mail and outdoor advertising. In this way NSP achieves maximum cumulative effect from its program.

But the company also has an elaborate and carefully worked out program of advertising in cooperation with appliance dealers scattered throughout its broad territory. In a series of meetings in every one of its 13 divisions, NSP personnel outline for dealers the company's promotional advertising scheme for a full year. Dealers are urged to tie their own advertising to that framework to achieve the greatest impact.

Northern States gives dealers a calendar of appliance promotions,

Win Prizes?

and urges them to follow it. Such a calendar for 1958 has been in the works for several months. It suggests that dealers push ranges in September, water heaters in October, clothes dryers in November, and so on. Along with the calendar go reprints of ads the company plans to use—"ads that build desire for the appliances you sell," the dealers are told.

All of Northern States Power Co's advertising is not promotional. And the message varies with the audience toward which it is directed and with the purpose of the ad.

But NSP has been successful all around. Simple, purposeful, well organized material has won for the company awards in public relations, financial, and motion-picture advertising. The company's 1956 annual report took top honors in the "Reddy Kilowatt" annual report contest, and Financial World's "best of industry" award as well.

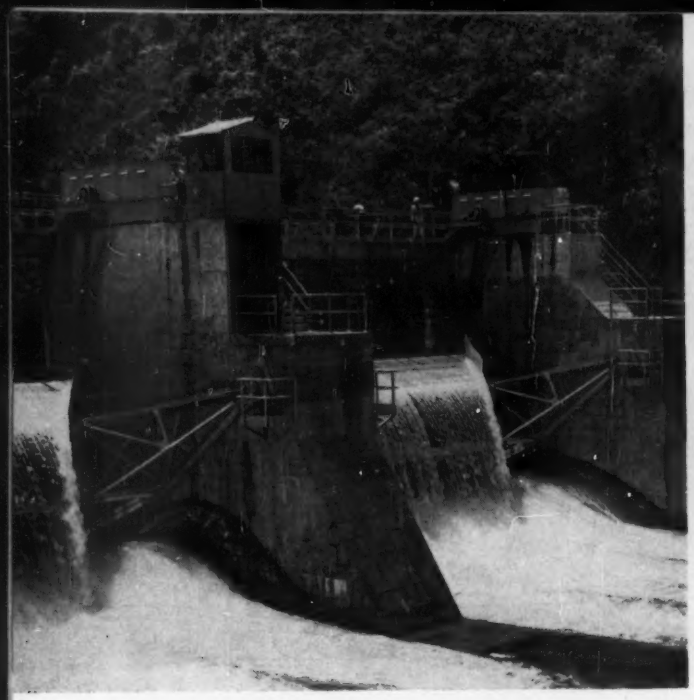
Ads Come from People

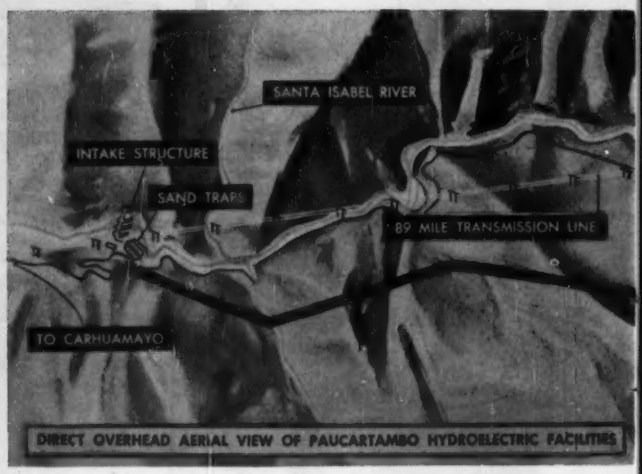
Behind all these achievements is Northern States Power Co's information and advertising department. It is a part of the public relations department, of which J. A. Busch is vice president. The information and advertising department dates from 1950. At its helm since its birth has been R. D. Furber, an electrical engineer with more than 20 years' experience in NSP's sales department (at right in the picture above). This year Furber was elected president of the Public Utilities Advertising Association.

L. J. Donley (at left in the picture), NSP's advertising manager, has been in on the company's whole success story. He began creating prize-winning advertisements for Northern States in 1928, and is still at it. Since 1950 the company has also employed an advertising agency, Campbell-Mithun of Minneapolis.

Here's the 1957 crop of NSP awards:

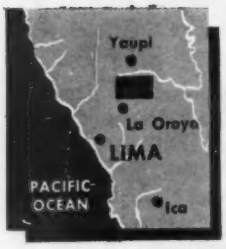
First Award	PUAA	Competition	Booklet distributed to customers
Second Award	PUAA	Competition	Public relations newspaper advertising
Second Award	PUAA	Competition	Newspaper advertisement promoting gas
Third Award	PUAA	Competition	Complete advertising program
Third Award	PUAA	Competition	Direct mail advertising
Third Award	PUAA	Competition	Institutional television advertising
Third Award	PUAA	Competition	Outdoor advertising
Top Award In All Classes	Reddy Kilowatt Annual Report Contest		NSP 1956 Annual Report





DIRECT OVERHEAD AERIAL VIEW OF PAUCARTAMBO HYDROELECTRIC FACILITIES

Hydro Power



• Cerro de Pasco harnesses turbulent Paucartambo River to gain 65 Mw for mining operations
• Engineers defy obstacles of towering mountains to build $31-million project

On the rugged terrain of the Peruvian Andes, a modern 65,000-kw hydroelectric project has begun operations, introducing 20th Century industry and civilization to the ancient empire of the Incas.

The $31-million project, built by Cerro de Pasco Corp, was designed mainly to alleviate an acute drought-induced power shortage which has curtailed the firm's mining operations in the Central Andes area for the past few years.

The Paucartambo project was also needed to provide power for the company's expanded program of mining and refining of zinc, copper, and lead in the La Oroya area.

Mountains Hamper Construction

But because of the project's location in a steep and isolated mountainous area, many obstacles had to be overcome before these goals were reached.

Engineers were faced with the tasks of boring a tunnel through fault zones, moving equipment up and down mountains more than 15,000 ft above sea level, erecting towers and stringing lines across a canyon and between mountain peaks, building access highways, and overcoming the hazards of a high lightning incidence.

One of the most difficult, and outstanding engineering feats of the project was driving the eight-mile tunnel which connects the dam and headworks with the penstocks.

To construct the horse-shoe shaped facility, workmen had to bore through various fault zones, where they encountered badly fractured and broken rock and ground waters. As a result, 61% of the tunnel's total length is fully concrete lined. The entire floor is paved with concrete.

Another obstacle—erecting the penstock and lowering the heavy equipment to the powerhouse—was solved through construction of an inclined railway. Running parallel to the penstock, it has a maximum gradient of 50%. The railway cars, powered by a 250-hp hoist, inch their way up the slope at 2.5 mph.

The penstock itself is 3,800 feet long and pitches down the mountain from the end of the tunnel at Yaupi Alto to the powerhouse 1,500 feet below. At the powerhouse it branches into three tubes, each of which feeds water to a 24,000 kva turbine.

Powerhouse Provides Repair Facilities

In designing the powerhouse, engineers had to take into consideration the fact that equipment breakdowns could be costly if parts had to be shipped any distance for repairs.

The result was a tropically colored structure—with Chinese red generators and green, orange, yellow, and black turbines and pipes—which efficiently houses not only three 21,600-kw generators but contains the facilities for almost any necessary equipment repairs.

Included in the powerhouse are a modern machine shop, an automatic fire extinguisher system, and a small track which runs from a nearby transformer station to the powerhouse. This enables a transformer to be brought in to a 15-ft pit inset into the floor so that its core may be removed for repairs.

Another outstanding engineering feature of the project is the 89-mile transmission line. It is unique in that:

• It marks the first time a 138,000-v high tension line has been installed at altitudes above 12,000 ft.

• At one point it stretches 3,720 feet from one peak to another across the Manto valley, thus making

Is Tunneled Through Peru's Peaks

it one of the longest spans of this type in South America.

Another stumbling block to successful completion of the project was erection of 568 towers of two, three, and five-pole construction in the mountains through which the line passes.

This was solved in many instances by first using a Lyle gun to shoot a rope across the canyon. This procedure helped workmen to pull wooden poles and transmission cable into position.

Many of the towers had to be erected by using a cableway supported by fabricated steel towers or by dragging the poles up the mountainside with block and tackle.

Since the incidence of lightning in the Peruvian Andes is among the highest in the world, it was necessary to increase lightning protection and to lower the structural footing resistance. This was done by burying counterpoise wires the entire length of the 89-mile transmission line.

The three-generator Paucartambo project, completed now after six years of construction, has an initial installed capacity of 65,000 kw. Since Cerro de Pasco already receives 73,000 kw from its three hydro plants and one steam plant in the area, the new project just about doubles the company's firm power generating capacity.

Danger of Dry Spell Decreased

The Paucartambo project is expected to provide this needed power even in years when rainfall is abnormally low.

This was virtually assured by construction of a concrete arch dam, diversion tunnel, and connecting tunnel which, during the dry season, will work to divert water from the Manto River into the main tunnel to supplement the supply from the Paucartambo River.

In addition it is planned that, in the future, a short diversion tunnel will be constructed to connect the Santa Isabel river to the pond above the dam, thus providing additional flow.

The headworks can handle 50,000 cfs flood flow. From the 230-ft dam water, enters dual-basin sand trap and forebay

A 3,800-ft penstock plunges down the mountainside to feed water to the powerhouse 1,500 ft below in the river valley

The News-Beat

A General Fights for Power

Mexican Light & Power Co is going all out in its fight to avert a severe power shortage, the worst effects of which would be felt next March or April. The threatened shortage was caused by an almost unprecedented lack of rainfall during the recent wet season, which left storage dams at dangerously low levels.

General William Draper, Jr, Mexlight president, has taken these steps:

- Asked all residents to use only necessary power
- Advised industrial concerns with private generating power to make sure the equipment is operable
- Reduced its normal voltage 5%
- Induced the Mexican government to place into operation its own emergency units which are yielding another 10,000 kw
- Leased from the U. S. Navy a 10,000-kw rail-mounted unit
- Begun a round-the-clock program to boost Mexlight's thermal capacity another 94,900 kw. Of this, it is hoped 82,400 kw will come from a new unit, largest in Mexico, originally slated for operation next July. Now all efforts are concentrated on getting it on the line by the end of April.

Hydro and Heat Pumps

A 500-Mw hydroelectric plant, reportedly the largest rated hydro station in southeastern U. S., is being seriously considered for construction in the TVA area. The $100-million project, slated for the upper Cumberland river, would be built by the Corps of Engineers.

Meanwhile, it's been predicted that a total of 1,500 heat pumps will be installed in TVA area next year. The prediction was made at the recent annual meeting of utility managers and General Electric dealers.

Power Dive

A young parachutist recently made a landing on a 110,000-v transmission line near Tacoma, Wash. And as firemen were cutting Ronald Herzog down, the entire city was blacked out.

Initially, Tacoma City Light officials could see no other reason for the power failure. But later the outage was traced to the failure of oil switches in the city's Cowlitz substation.

Deepening 'the Hole'

A bill which would allow cities and towns to borrow outside their debt limits to establish, purchase, extend, or enlarge electric or gas plants has been filed for consideration by the 1958 Massachusetts legislature.

And another proposal, this one filed for the Municipal Electric Assn, would authorize cities and towns to acquire, construct, improve, and maintain revenue-producing facilities and to finance them.

The Dark and the Dangerous

Co-ops should shut off all electric power for one day each year, "just to remind people what it was like B. E.—before electricity."

This suggestion came from Tom Nelson of New York City at the recent 11th annual convention of the Kentucky Association of Rural Electric Co-operatives. His suggestion followed a warning to co-op directors and managers to avoid a sense of complacency during this "dangerous age" for co-ops.

Distaff Director

A Montana grandmother of 14 children, who believes "women have more at stake than men" in the rural electrification field, is the first woman member of the Wisconsin Electric Cooperative board of directors.

She's Mrs. Andrew Dahl, president of Sheridan Electric Cooperative of Medicine Lake and director of Northwest Public Power Assn. Active in co-op work for 25 years, she became interested "because I was in hopes that through building rural electricity we could get away from the drudgery that attends work on the farm."

These Dam Rumors . . .

Reports of leaks in its John Hart Dam have been labeled as "ridiculous" by British Columbia Power Commission. The earthfill dam is third step in BCPC's Campbell River hydro development on Vancouver Island. The charge was made by the village commission of Campbell River.

Claiming the charge was based on "mere rumor" and not on fact, Manager H. L. Briggs explained: "In June, a section of the steel lining of a tunnel in the Upper Campbell River construction tore loose because of vibration, and was removed from the tunnel. There was no damage to the concrete tunnel itself," he said.

He added that delays in the project and importing of electrical energy from the U. S. this autumn were the result of a labor dispute in the Tunnel and Rockworkers' union and of heavy rains last year which damaged log booms and bridge trestles connected with the project.

SCHOLARSHIP AWARDS went to six winners in Westinghouse's 4-H Club Electric Program. Left, kneeling: Ed Polovich, Novinger, Mo.; and Don Chapman, Dora, N. M. Standing from left: Frank Eaton, Carbon Hill, Ala.; Ed Wharff, Ellicott City, Md.; Catherine Harrington, Mattson, Miss.; and Vicki Rouse, Whitewater, Colo. With them are Westinghouse vp's C. J. Witting, who directs consumer products, and C. V. Roseberry, mid-western region

4-H'ers Look for New Electrical Ideas

Westinghouse's Power Supplier Conference, tied in with 4-H Club Congress, is sparked by 'brainstorming' sessions, awards, and new farm films

New ideas for improving 4-H Club electric project activity was the theme of Westinghouse's Power Supplier Conference held last month in Chicago. Tied in with the National 4-H Club Congress, the confab drew sales people from power companies and rural electric cooperatives throughout the country.

Another highlight was the presentation of $400 scholarships to the six top 4-H'ers participating in the company's program. Main purpose of this program is to find new and better ways to use electricity on the farm.

Idea boosts for bettering the project came from many quarters. Examples: "Brainstorming" techniques from an oil company; a new series of films from a Michigan university; and joint 4-H'er-agricultural engineer panel discussions.

On a popularity basis top billing would have to go to the brainstorming sessions introduced by Ethyl Corp's C. S. Clark. Everyone got in the act, and everyone seemed to enjoy it.

How does brainstorming work? Briefly: A group is assembled to tackle a given problem. Group size is critical; generally, six to 12 persons is considered best. The group leader tosses the problem on the table, and members fire off their ideas. They can say anything they wish, with no fear of being shouted down or pooh-poohed, because at this stage, all critical comment is suspended. Idea is to get rough creative ideas. These are then filtered, refined, and discarded. What's left is polished and put in presentable form for management.

Did the technique work? Said one young would-be farmer: "Gosh, I never knew all the ways to use electricity in farming. Maybe I'll have to be an engineer to get a good crop!"

Another item on the conference agenda that attracted much attention was Michigan State University's new film series. Presented by MSU's Marie Wolfe, it is made up of thirteen 30-min shows and stars 4-H Club members rather than a professional cast. The youngsters themselves were used in order to cut production costs and hence the price to power suppliers who may want to use the films in their rural load-building programs. Cost, according to Miss Wolfe, will be $1,200 for the series. She left undecided the question of whether they might be rented.

Awards to the six winners of scholarships were presented at a dinner given by Westinghouse. The all-expenses-paid trip to Chicago was also part of their prizes.

Computer Calculates Heat Rates

Periodic heat rates may be computed from performance test data to effect possible savings by advancing or deferring overhaul

C. F. WHITMER and W. M. STEPHENS, Design Engineers, Georgia Power Co, Atlanta, Ga.

Electronic computation of turbine heat rates from performance data has been justified economically by Georgia Power Co. The computer provides the calculation results quickly with minimum possibility of error and releases technical manpower for other activities.

This is the first step toward establishing economic frequencies for major turbine overhauls. With the results of periodic heat runs more readily available, the company hopes to maintain turbine efficiency at the most economic overhaul point. Periodically calculated heat rates will be used to determine whether scheduled maintenance should be accelerated or deferred.

Turbine test data obtained primarily by conventional plant instruments were processed in an IBM 650 computer which solved 79 equations to obtain the desired heat rates. The computer calculated data for six test runs at various valve points in about 12 min. Computer rental charge was about $12—only a fraction of the cost of the 500 to 600 man-hr previously required. The major computer cost was a non-recurring charge of $2,000 for preparation and solution of equations, program preparation, and computer rental to find program mistakes. This major cost will be written off through the use Georgia Power will make of the completed program for turbine heat rate calculations. For example, it can be decided whether anticipated improvement in heat rate will save sufficient fuel to justify the cost of a major overhaul. At one plant with three 100-Mw units, an increase or decrease of 1% in turbine heat rate represents over $50,000 annually in fuel cost. Without periodic heat rate calculations provided quickly and at low cost by a computer, considerable savings might be overlooked.

Initial work in establishing this test and computer method was limited to one plant, rather than trying to set up a procedure for all plants. However, many parts of the procedure are applicable to other generating units. The station selected, Plant Hammond, has three identical 100-Mw, 1,800-lb, 1,000/1,000-F turbogenerators. The test and computer method for one of these units, installed three years ago, will illustrate the procedure.

This is how the computer data were obtained. Shortly after the unit was installed, it received an ASME code performance test with full test instrumentation. Additional tests were made subsequently using conventional plant instruments. When the unit was overhauled, the latter were repeated, providing data from three tests.

Prior to each test, the steam and condensate cycle was isolated by closing all makeup lines, vents, drains, blowdowns, etc. The evaporator was not operated during the tests. All pump leakages and boiler feed pump quench water flows were determined by weighing flows for 5-min periods each 15 min. Total system loss was determined by observing the change in levels of the deaerator storage tank, condenser hotwell, etc.

Turbine exhaust pressure was adjusted approximately to contract pressure (2.0 in. Hg abs) by bleeding air through a valve manifold connected to the condenser vacuum breaker line. Condenser pressure was measured by the station mercury column.

Load point for each test was selected by using a full-open admission valve point to permit exact duplication for subsequent tests. After admission valves were set, the unit was "leveled-off" for about 2 hr. Actual test for each valve setting lasted 2 hr; data were recorded at 10 or 15-min intervals, depending on the individual data station.

After each of four test runs began, the first few readings of throttle, cold and hot reheat, and stage conditions were averaged and corrected for water legs, atmospheric pressure, etc. These pressures and temperatures then were plotted on a 4x10-ft Mollier diagram, on which had been plotted approximate steam expansion lines from contract data. Relation of the contract expansion lines with the test plots permitted correction of bad readings before the test progressed too far.

How Pressures Are Measured

Pressures were measured by station gages calibrated prior to the first tests. To check on station instruments, laboratory-type bourdon-tube test gages and mercury or water manometers were installed at certain points. Temperatures were obtained using glass thermometers in test wells and iron-constantan thermocouples with laboratory-type potentiometers. Thermocouples were employed at high-temperature points and inaccessible locations.

Condensate flow, determined by the station flow meter, was the principal flow measurement for the calculations. Mercury manometers measured the differential across the flow orifice in each low-pressure dummy leak-off line. Turbine leakages which were not measured were determined from manufacturer's curves. Electrical output was determined by revolution count of the station watthour meter.

This instrumentation does not meet the high accuracy recommended for ASME code tests, and results do not give actual turbine performance. However, comparison of test results (Fig 1) before and after turbine overhaul provides a reasonably accurate indication of changes in performance resulting from overhaul. Heat rates determined by testing one turbine showed an average improvement in heat rate of 145 Btu/kwhr at low load and 170 Btu/kwhr at high load. Average overall improvement in heat rate was about 1.85%.

Test data were processed at Georgia Institute of Technology computer center on a 650 computer. Instructions, constants, and test data were prepared on punched cards. Results on punched cards were fed through a printing machine to put them in a printed

Adapted from a paper presented at Southeastern Electric Exchange Engineering & Operating Section

to Set Economic Turbine Overhauls

form which may be analyzed easier than cards.

Five steps were necessary for computer calculation of turbine heat rate:

1. Familiarization with computer equipment to determine what could and could not be done.

2. Preparation and solution of all equations manually with one set of test data to find correct answers to each step.

3. Preparation of a computer calculation sequence diagram.

4. Translation of all calculations into computer language.

5. Verification of the computer program to eliminate mistakes.

One objective in preparing the program was to have the computer solve the complete problem without stopping. The problem was resolved by writing equations to fit the curves. In some instances, curves were separated into two or more segments with individual equations for each. The computer was instructed to select the segment applicable to previously calculated results. Because heat-rate calculations had been performed previously by hand, many equations had already been established.

In writing the heat-balance and flow equations for the program, all alternate flow paths had to be included. For example, as shown in Fig 2, the 18th-stage heater drains to the 23rd-stage heater at high loads and to the 26th-stage heater at low loads. Flow changes of this sort require entirely different calculations. In handling alternate flow conditions, each item of data was coded by letter rather than by number to avoid confusion with constants.

Punching field data into cards required about one hour per test run. It was necessary to identify data

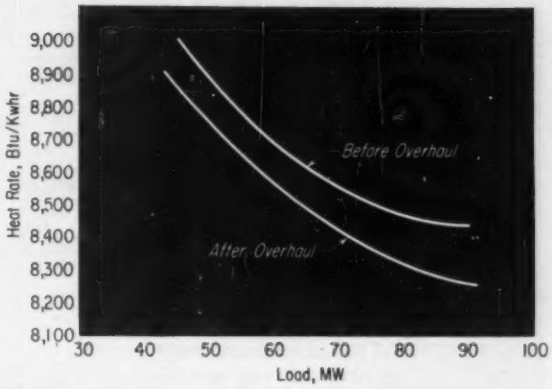


FIG 1—TURBINE HEAT RATE was improved about 1.85% by overhauling unit. Periodic computer calculations will provide a quick and low-cost check on change in heat rate

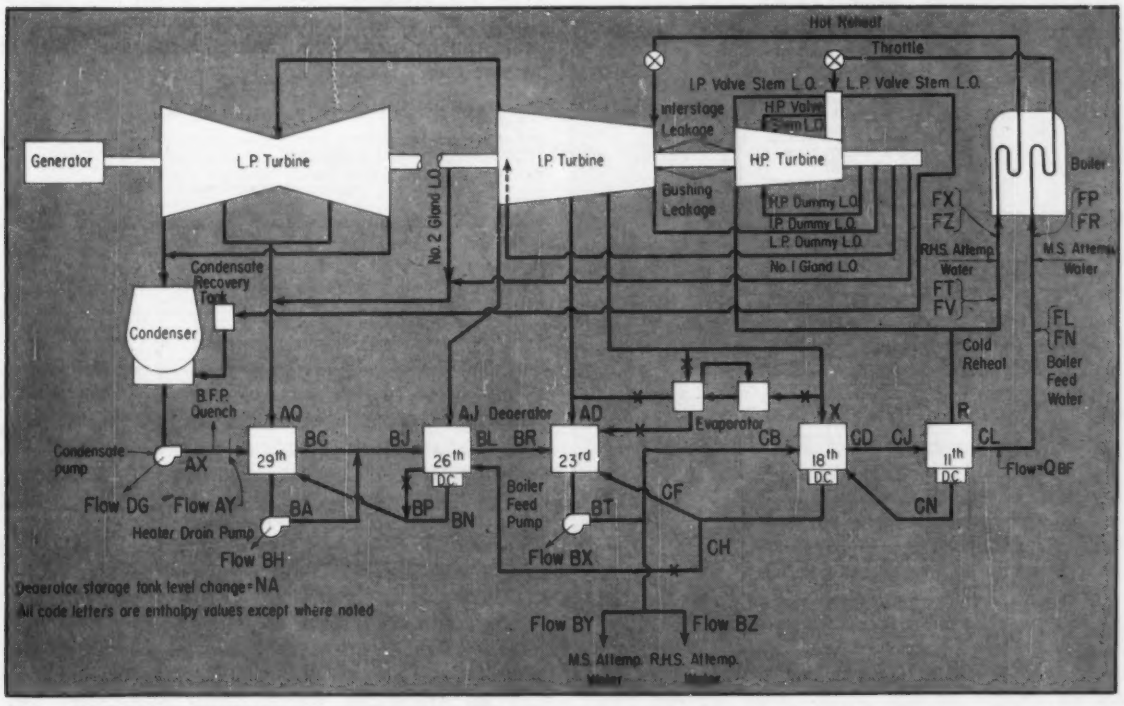


FIG 2—ALTERNATE FLOW PATHS in the steam and condensate cycle must be included in writing heat-balance and flow equations. Values of enthalpy CF and CH represent the alternate drains from the 18th-stage heater. The computer is programmed to examine these values and use only those equations applicable to the existing flow arrangement

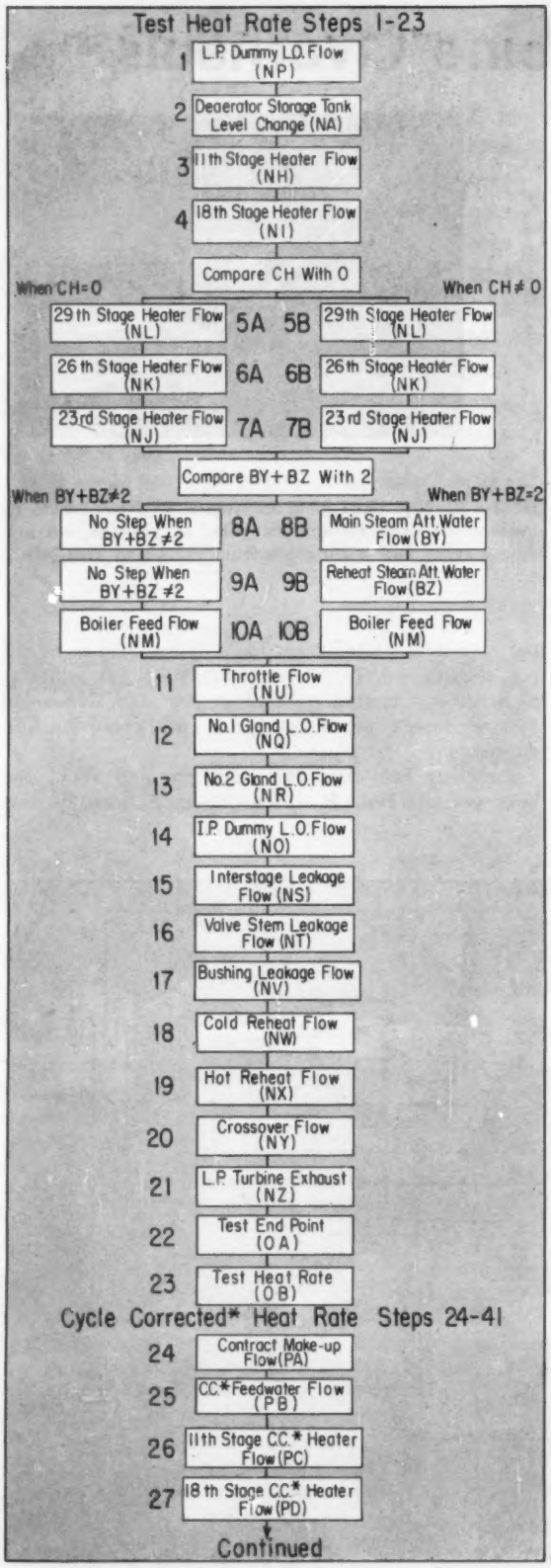

Test Heat Rate Steps 1-23
1 L.P. Dummy L.O. Flow (NP)
2 Deaerator Storage Tank Level Change (NA)
3 11th Stage Heater Flow (NH)
4 18th Stage Heater Flow (NI)
Compare CH With 0
When CH=0
When CH≠0
29th Stage Heater Flow (NL) 5A 5B 29th Stage Heater Flow (NL)
26th Stage Heater Flow (NK) 6A 6B 26th Stage Heater Flow (NK)
23rd Stage Heater Flow (NJ) 7A 7B 23rd Stage Heater Flow (NJ)
Compare BY+BZ With 2
When BY+BZ≠2
When BY+BZ=2
No Step When BY+BZ≠2 8A 8B Main Steam Att. Water Flow (BY)
No Step When BY+BZ≠2 9A 9B Reheat Steam Att. Water Flow (BZ)
Boiler Feed Flow (NM) 10A 10B Boiler Feed Flow (NM)
11 Throttle Flow (NU)
12 No.1 Gland L.O. Flow (NQ)
13 No.2 Gland L.O. Flow (NR)
14 I.P. Dummy L.O. Flow (NO)
15 Interstage Leakage Flow (NS)
16 Valve Stem Leakage Flow (NT)
17 Bushing Leakage Flow (NV)
18 Cold Reheat Flow (NW)
19 Hot Reheat Flow (NX)
20 Crossover Flow (NY)
21 L.P. Turbine Exhaust (NZ)
22 Test End Point (OA)
23 Test Heat Rate (OB)
Cycle Corrected* Heat Rate Steps 24-41
24 Contract Make-up Flow (PA)
25 CC* Feedwater Flow (PB)
26 11th Stage CC* Heater Flow (PC)
27 18th Stage CC* Heater Flow (PD)
Continued

FIG 3—SEQUENCE DIAGRAM for computer (in partial form) arranges the 79 equations or steps in the same order that the computer will follow in solving the heat-rate problem

to be punched to distinguish them from supporting data, (Fig 4).

Values of enthalpy CF and CH represent the alternate drains from the 18th-stage heater in Fig 2. In this test the 18th-stage heater was draining to the 23rd stage. Value of enthalpy for alternate flow to the 26th-stage heater is shown as ten zeros. The program instructs the computer to examine these enthalpy values and use only those equations applicable to the flow arrangement. To complete the calculations, 79 equations or steps were required. Answers to at least one complete calculation and all alternate flow paths were required to check errors in the computer program.

Put Field Data in Simple Form

Another objective in preparing the program was to put field data in the simplest and most direct form. For steam and liquid properties, such as enthalpy, a prefix to the program permits the 650 to compute them directly. Next step was to prepare a computer sequence diagram. A portion of this diagram, steps 1 through 27, is shown in Fig 3. This is a step-by-step arrangement of calculations in the same order that the computer will follow in solving the problem, including all alternate possibilities.

When the sequence diagram and all equations were completed and checked, they were given to a computer consultant to write the program. The final result was a deck of punched cards. After the program was checked and all errors eliminated, the deck was duplicated as insurance against loss or damage.

Georgia Power's program deck comprises about 575 instructions and 115 constants. Field and supplementary data for each test run comprise 90 values. After the computer receives the cards, any number of test runs can be computed consecutively. The program can be used for all future calculations on these turbine units.

GEORGIA POWER COMPANY
PLANT HAMMOND - UNITS 1, 2 & 3
TURBINE PERFORMANCE TEST

Page 4

Problem No. 2011

TEST NO. 01

CODE	DESCRIPTION	UNITS	CARD NO.	LOC.	VALUE	DEC.
CA	Feedwater to 18th Temperature	°F			3134	
CB	" " " Enthalpy	BTU/#	06		29170000	52
CC	Feedwater From 18th Temperature	°F			3760	
CD	" " " Enthalpy	BTU/#	07	604	35160000	52
CE	18th Drain to Deaerator Temperature	°F			3277	
CF	" " " " Enthalpy	BTU/#	07		29460000	52
CG	18th Drain to 26th Temperature	°F			0	
CH	" " " " Enthalpy	BTU/#	07		0000000000	
CI	Feedwater to 11th Temperature	°F			3760	
CJ	" " " Enthalpy	BTU/#	07		35160000	52
CK	Feedwater From 11th Temperature	°F			4549	
CL	" " " Enthalpy	BTU/#	07		43630000	52
CM	11th Stage Heater Drain Temperature	°F			4135	
CN	" " " " Enthalpy	BTU/#	07		38770000	52

FIG 4—FIELD DATA to be punched are identified (black boxes) to distinguish them from supporting data, which are not punched. Six items of data are punched into one card

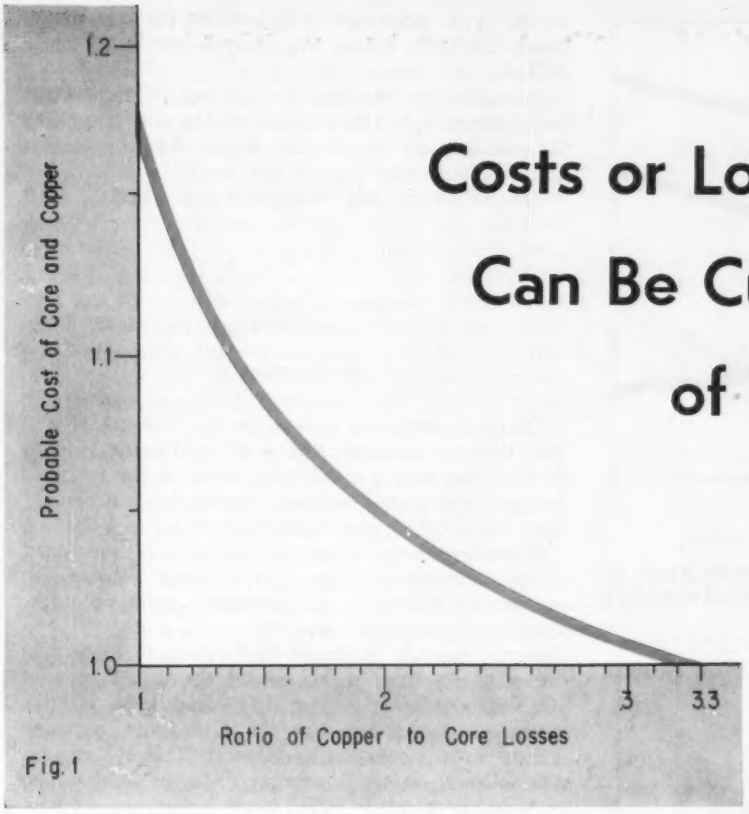


Fig. 1

Costs or Losses? Either Can Be Cut, but Users of Transformers Must Agree

- Designers can produce an optimum-efficiency distribution transformer by changing the ratio of copper to core losses
- But users must first agree on a standard loss ratio, the key to optimum design, to take advantage of mass production

J. B. HODTUM, Manager, Central Station Engineering Department, Pittsburgh Works, Allis-Chalmers Manufacturing Co, Pittsburgh, Pa.

The optimum-efficiency distribution transformer, designed to fulfill the requirements of all users, can be obtained if users agree on the best ratio of copper to core losses. This agreement is essential because standardized design is the basis of economical mass production.

The ratio of losses that will give this optimum efficiency over a transformer's useful life depends on the loss factor of the load, the relative cost of copper and core losses, the expected rate of load growth, and the peak load on the unit at installation and retirement.

Designers can change the ratio of copper to core losses; they can also modify the impedance or reactance. But users must agree among themselves on such changes before the designer can develop a line of transformers best suited to all service conditions. Even then, deviations from standard designs for the sake of achieving lower losses may boost transformer cost more than can be justified by operating savings.

Although an accurate estimate of the cost of changing the ratio of losses may vary, the probable relationship between material cost and changes in ratio is shown in Fig. 1. Reducing the ratio of copper to core losses from 3.3:1 to 1:1 may raise the cost of core and copper as much as 17.5%.

In this analysis it is convenient to consider that, for a change in ratio of the losses, the product of the losses remains constant. This product, generally referred to as the loss product factor of a transformer, is the percent core loss times the percent copper loss. Or it may be expressed as the product of the losses divided by the square of the rating.

As it is assumed that the product of the losses remains constant, the analysis can be applied to any rating. The impedance of the transformer is also assumed to remain constant for changes in the ratio of

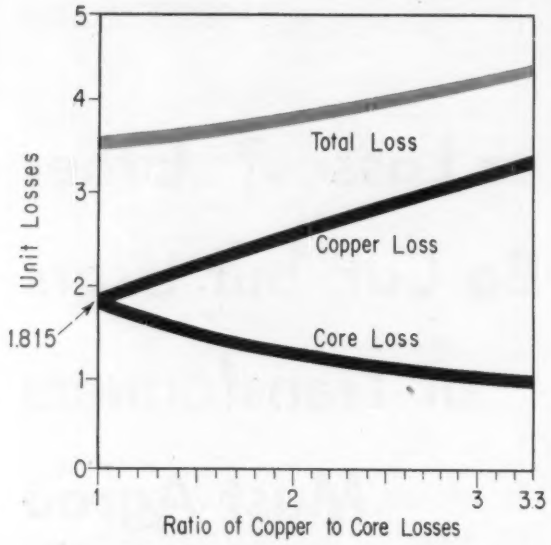


FIG 2—DECREASING THE LOSS RATIO to unity boosts the core loss 81.5%. But total loss has been reduced about 15%

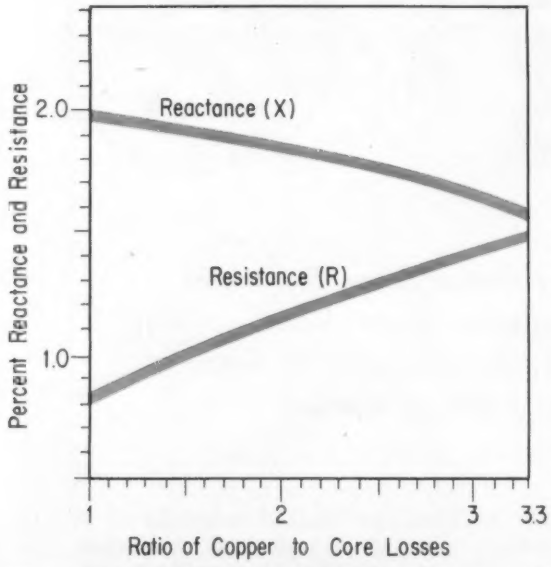


FIG 3—PERCENT RESISTANCE DECREASES and reactance increases with lower loss ratios and constant impedance

losses. A different approach, keeping the sum of the losses constant, makes the analysis somewhat more difficult.

Assuming that the average distribution transformer today has a 3.3:1 ratio of copper loss to core loss, the core loss can be considered unity and copper loss 3.3. The total loss at rated kva would be 4.3.

These relations may be expressed as follows:

$$\text{Core loss} = \text{Fe} = \sqrt{\frac{P}{N}}$$

$$\text{Copper loss} = \text{Cu} = \sqrt{PN}$$

$$\text{Product} = P = N(\text{Fe})^2$$

$$\text{Ratio} = N = \frac{\text{Cu}}{\text{Fe}}$$

Decreasing the loss ratio from 3.3:1 to 1:1 (Fig 2 and Table I) increases the core loss from unity to 1.815. Thus core loss is 81.5% higher at the 1:1 ratio than at 3.3:1. At the same time copper loss is decreased from 3.3 to 1.815, and total loss from 4.3 to 3.63.

If the impedance of the transformer is also assumed to remain constant as the ratio of losses is decreased, the percent resistance, R, decreases and percent reactance, X, increases (Fig 3).

Furthermore, a reduction in the ratio of losses improves the voltage regulation of the transformer at 100% power-factor loading (Fig 4 and Table II). As the ratio of losses decreases, the transformer reactance increases for a constant impedance. Thus the regulation falls off at the lower power-factor loads. The explanation of this is found in the equation:

$$\%\ \text{Regulation} = 100\{\sqrt{(p+r)^2 + (q+x)^2} - 1\}$$

$$r = \frac{\%R}{100} \qquad x = \frac{\%X}{100}$$

where p is the cosine and q the sine of the load-power-factor angle.

The effects of these changes in ratio can be studied by analyzing typical load cycles for winter and summer urban loads (Fig 5). The daily loss factor for the load cycle in these cases represents the sum of the square of the loads divided by the product of the peak load squared times 24. For example, the 0.596 loss factor, for summer urban load, indicates that the total copper loss for that cycle is equal to

Table 1—Transformer Characteristics When P = 3.3

N	Fe	Cu	P	% Load for Max. Efficiency L	Total Loss 100%L	Total Loss 150%L
3.3	1.000	3.300	3.3	55.1	4.300	8.425
2.8	1.085	3.040	3.3	59.8	4.125	7.925
2.3	1.198	2.755	3.3	66.0	3.953	7.398
1.8	1.354	2.438	3.3	74.6	3.792	6.839
1.3	1.593	2.061	3.3	87.8	3.654	6.233
1.0	1.815	1.815	3.3	100.0	3.630	5.900

0.596 times 24 hr, or 14.3 hr times the rated copper loss.

To calculate the average total copper loss per day, the logarithmic mean loss equation was developed (Table III). It is based on a constant percentage increase in load per year.

Fig 6 is obtained by adding equations two and three in Table III. Thus the vertical scale of Fig 6 shows the relation between the ratio N and the total daily losses for loads B and E in units of core loss.

Then plotting the ratio of total copper loss to total core loss for each load condition produced the curves of Fig 7. Maximum efficiency is attained when total kwhr of copper loss equals total kwhr of core loss over the loading cycle. Thus, the optimum ratio N can be determined when the evaluated cost per kwhr of copper loss equals that of the core loss.

Maximum operating efficiency for the No. 1 curve of Fig 7 would be reached at N = 1.4, the ratio of copper to core loss. Similarly, maximum efficiency for the other curves would be attained when the total copper loss equals the total core loss. If the yearly loss factor is less than the assumed daily loss factor of Fig 7, the curves would cross unity at higher values of N. If the evaluation of the copper loss is higher than the evaluation of the core loss, the curves would cross unity at lower values of N.

The effects of the rate of load growth and the peak load on a transformer at installation and retirement are illustrated in Fig 8. For example, at 7% annual load growth, a transformer would remain in service 10.25 years, if the initial peak load were 75% of nameplate rating and the retirement peak were 150%. But the same transformer would serve 16.2 years if load were only 50% of rating at installation and 150% at retirement.

Fig 6 indicates that the minimum average losses decrease as the peak of the initial load is decreased. However, this may increase investment costs, as a larger rating of transformer at higher capital cost would have to be installed. Inversely, starting at higher initial loads, smaller transformers at a higher cost per kva could be used, but the capital expense of changing transformers more often may offset this cost.

The design of the transformer depends largely on the ratio of its losses for a given product of losses. There are three important considerations for deter-

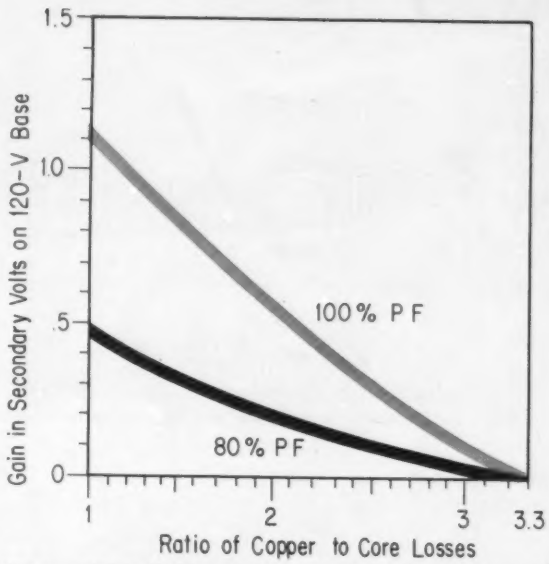


FIG 4—VOLTAGE REGULATION at 150% loading is improved greatly at 100% power-factor loading by lowering ratio

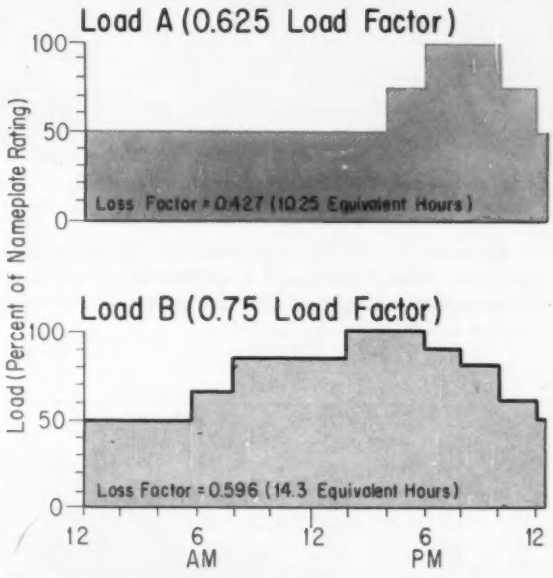


FIG 5—TWO TYPICAL LOAD CYCLES were analyzed to determine effects of changes in the ratio of copper to core losses

Table II—Transformer Regulation at 150% Load

(25 KVA, 2,400–120/240)

N	%Z	% R	%X	% Regulation at 150% Load		Secondary Volts (120-V Base)	
				100%PF	80%PF	100%PF	80%PF
3.3	2.2	1.505	1.604	2.2710	3.2533	117.335	116.219
2.8	2.2	1.386	1.707	2.0943	3.2037	117.538	116.275
2.3	2.2	1.256	1.807	1.9012	3.1384	117.761	116.349
1.8	2.2	1.110	1.900	1.6835	3.0478	118.013	116.451
1.3	2.2	.944	1.987	1.4379	2.9281	118.299	116.586
1.0	2.2	.828	2.04	1.2657	2.8390	118.500	116.687

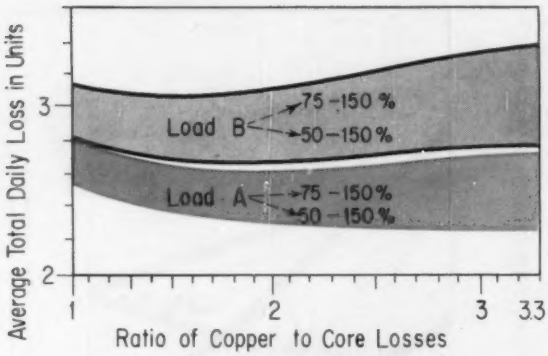


FIG 6—INSTALLING TRANSFORMERS at lower initial peaks reduces minimum average losses, but may raise investment

mining the best ratio of copper to core losses (N):

1. For maximum efficiency,

$$N = \frac{1}{(L)^2} \quad (L = \% \text{ of Rating})$$

2. For maximum material cost,

$$N = \frac{\text{Watts/Lb Cu} \times \text{Cents/Lb Fe}}{\text{Watts/Lb Fe} \times \text{Cents/Lb Cu}}$$

3. For minimum cost of losses on the load cycle and rate of growth,

$$N = \frac{2.305 \log_{10}\left(\frac{L_1}{L_2}\right)^2 \times \text{Cost of Fe Loss}}{LF \times [(L_1)^2 - (L_2)^2] \times \text{Cost of Cu Loss}}$$

Equation 2 is largely a problem for the transformer designer, while Equation 3 is dependent on the users' requirements and the relative evaluation of the transformer losses.

Table III—Logarithmic Mean Loss Equation

Average total copper loss per day equals:

$$(1)\ .4343 \left\{ \frac{(L_1)^2 - (L_2)^2}{\log_{10}\left(\frac{L_1}{L_2}\right)^2} \right\} \times \sqrt{PN} \times LF \times 24$$

When P = 3.3 this equation becomes:

$$(2)\ 18.92 \left\{ \frac{(L_1)^2 - (L_2)^2}{\log_{10}\left(\frac{L_1}{L_2}\right)^2} \right\} \times \sqrt{N} \times LF$$

The core loss per day equals:

$$(3)\ 24 \times \sqrt{\frac{P}{N}} \quad \text{or} \quad 43.58\sqrt{\frac{1}{N}}$$

Maximum transformer efficiency when (2) = (3):

$$(4)\ N = \frac{2.305}{LF} \times \left\{ \frac{\log_{10}\left(\frac{L_1}{L_2}\right)^2}{(L_1)^2 - (L_2)^2} \right\}$$

L_1 = max peak load at retirement; L_2 = max peak load at installation; LF = loss factor of the load.

For the general solution of Equation 1 for any values of P and N, the average copper loss per day becomes:

$$0.4343 \left\{ \frac{(L_1)^2 - (L_2)^2}{\log_{10}\left(\frac{L_1}{L_2}\right)^2} \right\} \times \text{copper loss at 100\% rating} \times LF \times 24.$$

The core loss per day becomes: 24 × rated core loss.

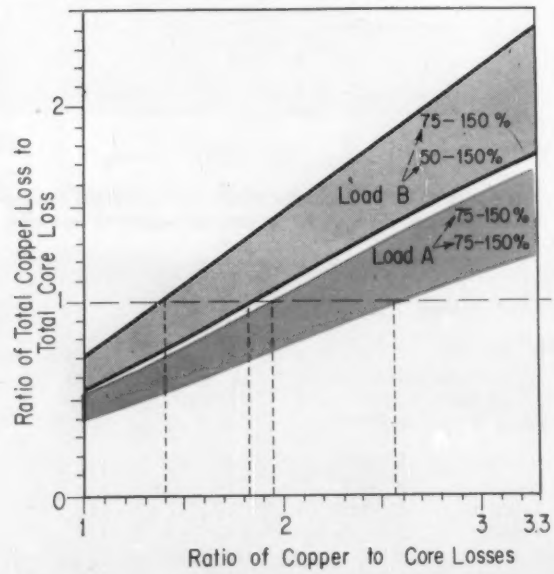


FIG 7—EFFICIENCY IS MAXIMUM when total kwhr of copper loss equals total kwhr of core loss over the loading cycle

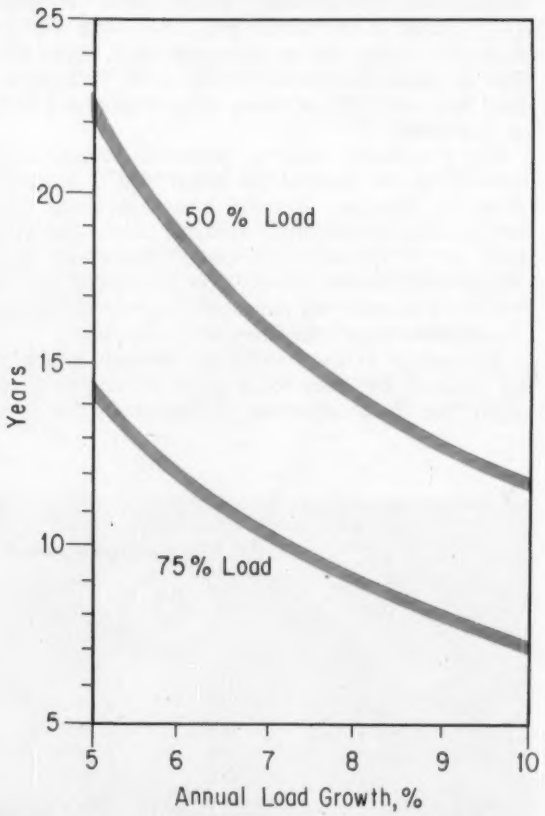


FIG 8—EFFECT OF INITIAL PEAK LOAD on transformer is significant. The curves are based on 150% retirement load

LOAD DISPATCH OFFICE is the emanation point for Indiana & Michigan Electric Co's new microwave system which provides channels for voice communications, telemetering and teletype, and supervisory functions. It looks to future needs

Plan Microwave to Meet Growth

Single-sideband multiplex system provides reliable and high-quality and accurate channelling at economical cost

W. R. ROY, Supervisor, System Communications, Indiana & Michigan Electric Co, Ft. Wayne, Indiana

Microwave is playing a major role in the expansion of Indiana & Michigan Electric Co's communications and control system. The initial installation promises reliable, high-quality, and accurate channeling for present needs, and flexibility for expansion to handle future communications requirements at minimum cost.

Need for more channels is underscored by the growth of communications requirements on the I&M system; they have increased an average of 10.4% annually based on channel-miles. Expansions in all phases of the communications system have left little room for additions to existing channels. The carrier-current system is confined to a limited spectrum which is saturated. To meet communications needs, the most logical choice for additional channeling was microwave.

Uses 17 Channels Initially

A 2,000-mc microwave system employing single-sideband multiplexing was selected on a basis of economy, operating characteristics, and versatility. Interconnections of communications channels with neighboring utilities, some of which use other makes of equipment, was an important consideration in selecting the make. The initial microwave system, installed between Robison Park and Deer Creek, uses 17 of the 72 channels available. Channeling will include service and fault indicating circuits, talk circuits, supervisory substation control circuit, and facsimile recording and transmitting circuits. Other uses are telemetering audio tone channel for impulse-type telemeters, telemeter signals for frequency-type telemetering, and carrier-current telephone extensions.

Many existing carrier-current channels are long-distance paths. Microwave will help reduce the length of these paths and thus provide greater dependability. The first leg of I&M's microwave system covers about 54 miles. One terminal point is at Robison Park Substation, 6 miles northeast of Fort Wayne, where the system load dispatcher is located. A drop-re-

All photos courtesy of RCA

OPERATING DEPARTMENT receives facsimile message via microwave

peater station is at Spy Run, in Fort Wayne, where the company's general offices and the Fort Wayne Division Headquarters are. A drop-repeater station was placed at Sorenson Substation and a simple through-repeater equipment at Warren Station. The other terminal station is at Deer Creek Substation, Marion, Ind., headquarters of the company's Marion-Muncie Division.

Uses Existing Towers

The preliminary aerial survey of the microwave path included a profile study of proposed and alternate routes made with radar-type altimeters. Oblique aerial photos of each site were obtained. Tower and antennae heights were determined from the profile studies and fresenel zone calculations. It was found that radio towers at Spy Run and Robison Park could support the parabolic antennae. Buildings at Robison Park, Spy Run and Deer Creek could house the indoor equipment.

Towers at the other three sites are 150-ft self-supporting at Deer Creek, and 225-ft guyed towers at Sorenson and Warren Stations. The single-sideband microwave system lends itself to use of flexible transmission cable and less rigid tower structures. Because these less-rigid structures were required, the use of existing towers saved steel and construction costs.

The single sideband multiplexing system occupies the narrowest bandwidth for 24 channels in the industry. Although now sufficient in most areas, available microwave spectrum is likely to change. There may be more users in the future for frequencies than there are frequencies available. Use of a narrow bandwidth now could eliminate changing multiplex equipment in the future.

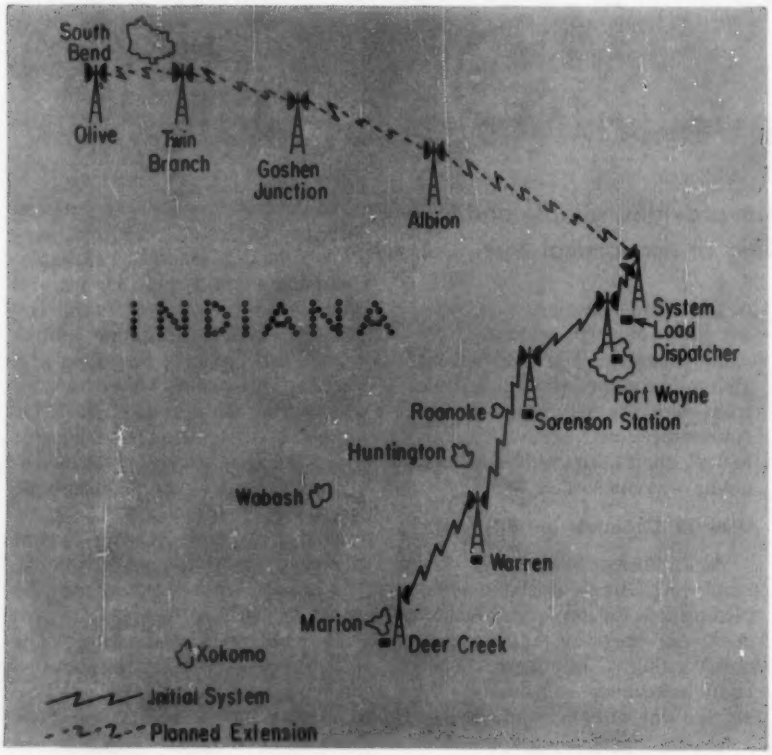
Reliability is 99.95%

The manufacturer of I&M's microwave equipment (Radio Corp of America) guarantees 99.95% reliability, which includes outage time during fades. This means a total outage time of only 4.5 hr per year because of propagation and equipment failures.

Future expansion of communications can be handled easily because of simplicity and flexibility of the equipment. In addition to the 72 voice channels available, as many as 20 "two-way" telegraphic channels may be superimposed on the 4 to 10-KC portion of the multiplex spectrum. I&M plans to use these channels for telemetering and supervisory control without resort to voice channels with audio-tone multiplexing. This feature of the equipment will mean a substantial gain in channeling at an economical cost.

Grows with Substation Capacity

The initial unused channel capacity will provide for growth in communications requirements. The need for more talk channels, telemetering, and supervisory control circuits will increase in the same proportion as substation capacity and greater automation in system operation. The future of automatic computers for accounting and operations is bright at this time. It is more than likely that microwave will feed data to these automatic devices.



MAP shows the initial system extending over the 54 miles from Deer Creek to Robison substations. Preliminary work is now already begun for its extension

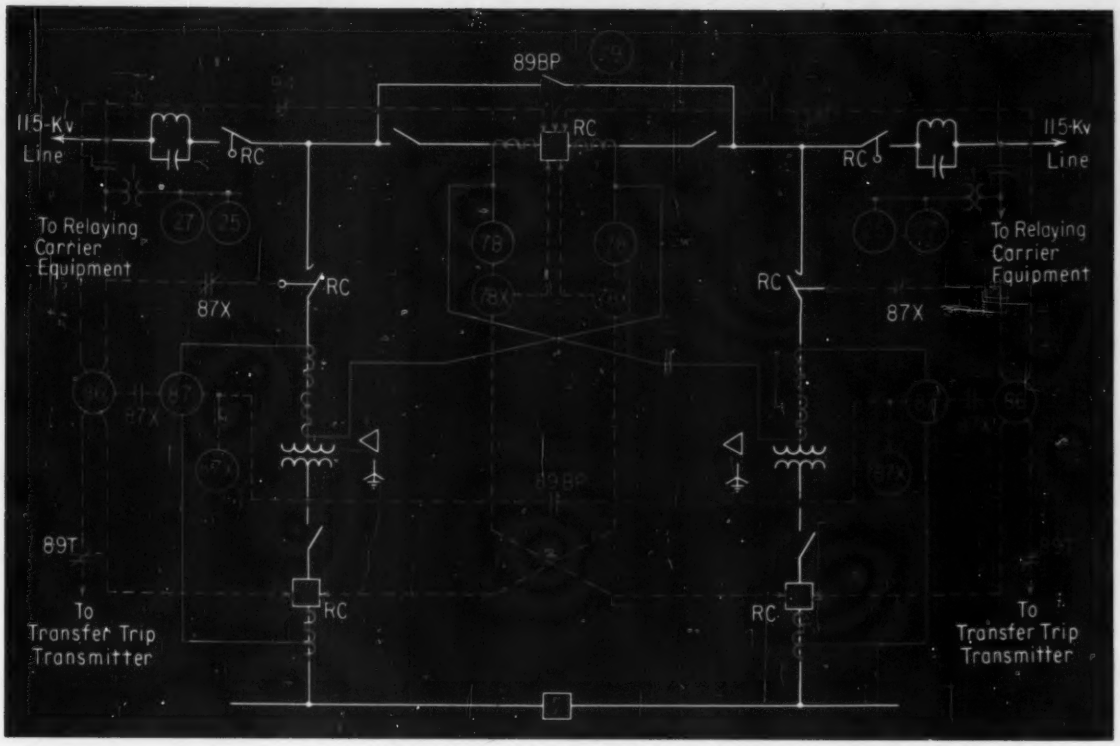


FIG 1—SIMPLIFIED SCHEME relies on phase-comparison carrier relays for primary protection. Line-impedance and directional-overcurrent ground relays at ends of the 115-kv lines provide back-up protection. Separate CT's are unnecessary

Line Relay Protection Simplified

Reduced costs follow use of phase-comparison carrier-current relays for primary protection of 115-kv lines feeding an "inserted" 13.8-kv distribution substation

RUBEN ZIMERING, Northern States Power Co, Minneapolis, Minn.

Simplifying the protective scheme for 115-13.8-kv substations "inserted" into existing transmission lines saves relaying equipment and power transformers for Northern States Power Co. The modified scheme provides only phase-comparison carrier-current relaying for primary protection of the 115-kv lines. For backup relaying, each line has line-impedance and directional-overcurrent ground relays at the remote end only.

This scheme eliminates four of the six bushing potential devices formerly used. There is less need for the more expensive three-winding power transformer banks with high and low-voltage grounded neutrals. Performance at three substations has been satisfactory, and other substations are planned which will use this protection system, as shown in Fig 1.

Substations protected by this scheme have two 115-13.8-kv transformers in 20 to 50-Mva sizes, fed by two 115-kv transmission lines. Such a substation usually is inserted into an existing line with little or no line construction. Past practice of Northern States Power was to design these substations with the protective scheme of Fig. 2.

In a typical old installation, two large wye-delta-zigzag transformer banks are each connected to a 115-kv bus section through a motor-operated disconnect switch. Two 115-kv lines connect to the bus sections through motor-operated disconnect switches, and a bus-tie breaker joins the two sections. Low-side breakers connect the transformer banks to one 13.8-kv bus.

Each line is protected by carrier-current impedance line relays, carrier-current ground relays, and directional-overcurrent ground backup relays on both ends. Relays are operated by totalized current transformers on one bank and on the bus-tie breaker. This arrangement obviates separate current transformers in the line proper. Relays trip the bus-tie and the low-side breakers for faults on their respective lines.

Each transformer bank is protected by differential relays operating a self-reset auxiliary relay (87X). This is turn operates a lockout relay (86) which trips and locks out the low-side breaker, and trips and temporarily locks out the 115-kv bus-tie breaker. Through a carrier-current frequency-shift transfer trip, the

lockout relay also trips and temporarily locks out the breaker at the remote end of the 115-kv line.

After breakers have tripped and the differential relays and auxiliary relay (87X) have reset, the bank high-side motor-operated disconnect switch opens to isolate the faulted bank. Opening of the disconnect switch blocks the transfer-trip signal. This removes the lockout from the remote-end and the bus-tie breakers.

This scheme provides each power circuit component with its full complement of protective relaying. The high-side line breakers were omitted with the advent of carrier-current transfer tripping. Relaying and control equipment were added to delegate the tripping function of these omitted breakers to those at either end of the 115-kv line.

When the modified protective scheme (Fig 1) is applied, substation layout is the same as formerly, except that transformers are delta-wye and 25-Mva capacity each. Bank differential protection is not changed; the difference is in the protection of the 115-kv lines.

Transmission lines feeding the substation do not have a full complement of line and ground carrier-current and line and ground backup relaying at both ends. Instead, each has only phase-comparison carrier-current relays for primary relaying. For backup protection, each line has line-impedance and directional-overcurrent ground relays at the remote end only. Each line is an independent unit with respect to the phase-comparison carrier-current relays. From the point of view of the backup relaying, the two lines together are seen as a single line.

No polarizing sources are needed at the substation for the impedance line and directional-ground relays. This eliminates four of the six bushing potential devices. There also is less reason for transformer banks with high-side grounded neutrals because there are no directional ground relays to polarize.

Transformer banks with high-side grounded neutrals would increase available ground-fault current. However, in most locations, originally available ground-fault current is sufficient for relaying.

Backup relays at the ends of the lines for the modified scheme must be set so as not to interfere with the primary phase-comparison carrier-current relays. The instantaneous zone of the backup relays cannot cover 90% of the total combined lines, but only 90% of one line (Fig 3). Otherwise the lines will trip together unnecessarily.

With the phase-comparison relays in service, each line will trip simultaneously at both ends for internal faults. With these relays out of service, only the remote-end breakers will trip, one instantaneously and the other with second-zone time, or both with second-zone time when the fault is within 10% of the lines on either side of the inserted substation.

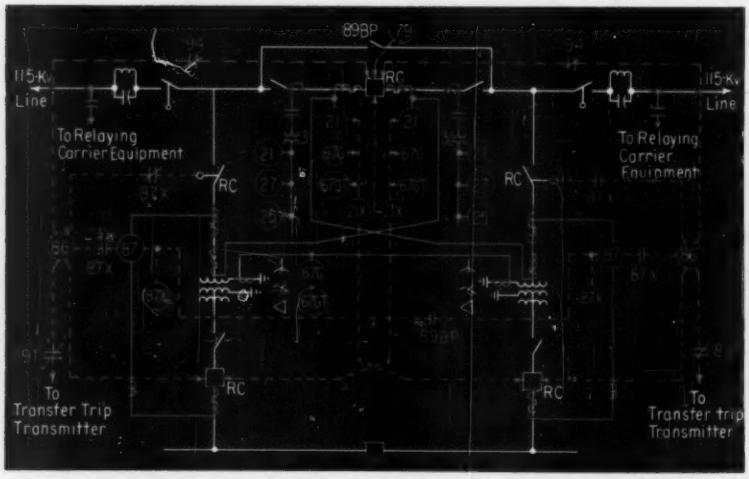


FIG 2—PAST PRACTICE provided 115-kv lines with a full component of line and ground carrier relaying, and line and ground backup relaying at both ends

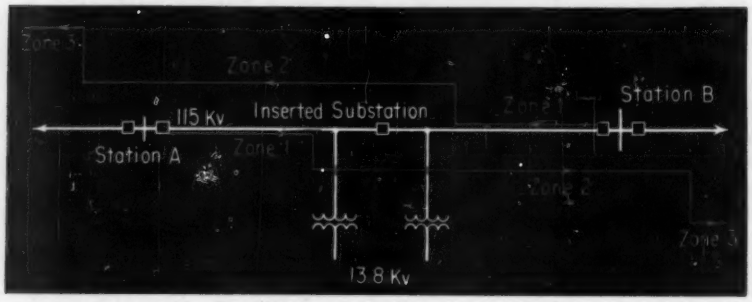


FIG 3—BACKUP RELAY SETTINGS in modified scheme should not interfere with primary relaying. Backup instantaneous zone should cover only 90% of one line

Four Operations Correct

Failure of carrier current will not prevent tripping by phase-comparison relays for internal faults, but tripping would not be blocked for external faults. Because this is unlikely to occur on both lines simultaneously, chances of loss of service to the substation are slight.

Of three substations with this modified protection, one has been in service about two years and the most recent for six months. Among five line operations, four were correct operations by the phase-comparison carrier-current relays. On the one occasion when phase-comparison relays did not clear a fault, the combined 115-kv line was tripped at the remote terminals by the backup relays. Cause of this carrier relay failure is not known.

The 115-kv breakers on these lines usually have automatic reclosing. Upon reclosing the line, including a transformer, magnetizing inrush may cause operation of the transformer differential relays and lockout of the transformer. This will require an inspection and resetting of the lockout relays at these unattended substations. To avoid such operation and lockout, harmonic restraint differential relays are used with the transformers.

Silent... and completely filled

General Electric capacitors don't gurgle because they are filled to the very tops of the bushings. Tip one and listen; test one with a stethoscope; or just tap it with a coin. You can double-check by looking into the glass bushings.

Why such tests? Because air bubbles in a capacitor can do more than gurgle. They can cause internal flash-over and failure. Even if the unit is mounted upright, you can't be sure a bubble hasn't been trapped in the winding to cause subsequent trouble.

No air gets in G-E capacitors because, after each unit is completely filled with Pyranol* under a vacuum pressure, the fill-hole is sealed under Pyranol. Result: no voids, no air channels, no weak spots where failure can start.

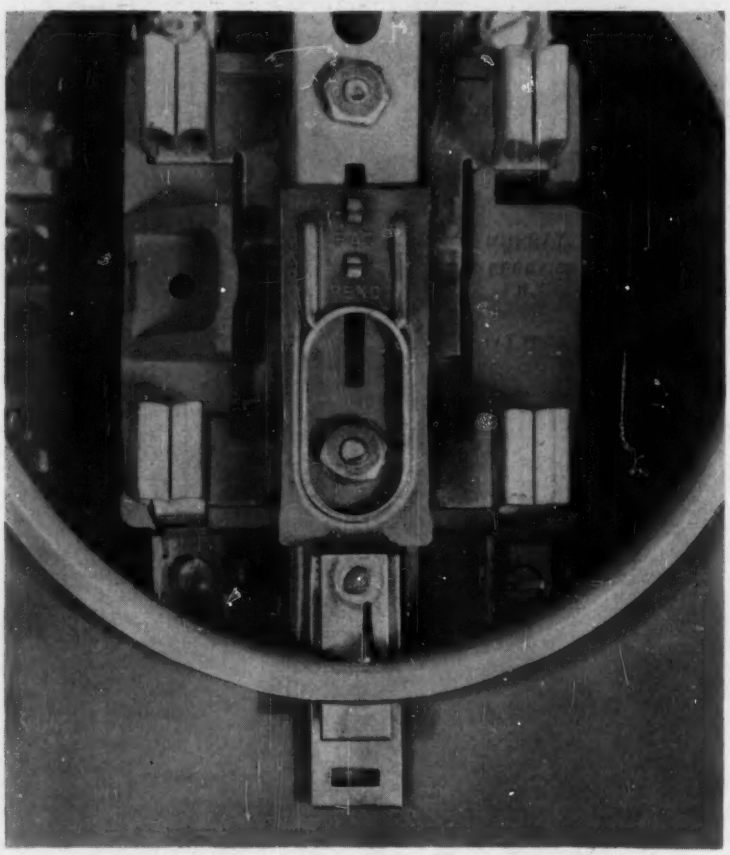
This is another of the Engineered Extras you get with G-E capacitors. Ask your General Electric Apparatus Sales Engineer to tell you more. Or write to General Electric, Section 445-5, Schenectady 5, New York.

*Reg. Trade-mark of General Electric Co.

Progress Is Our Most Important Product

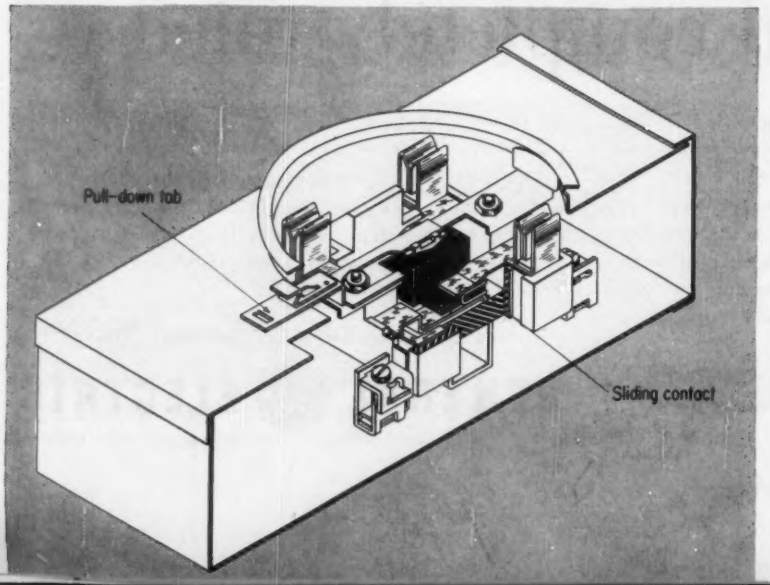
GENERAL ELECTRIC

Shunting Device Eases Meter Replacement



METER BYPASS is in open position as it would be with meter installed. The bypass serves to shunt the meter without interrupting customer's service

SLIDING CONTACT is moved by pull-down tab to bypass current from line to load jaws. Sealing ring must first be removed and meter raised slightly



TODAY'S DESIGN TREND

A manual shunting device integral to the unit enables a utility meterman to remove the meter from a new type meter socket without interrupting service. The meter mount fits in the standard multiple-unit trough used for residential customers.

A consequence of its adoption is that the company can replace meters with others and check the replaced one at its own laboratory rather than on the customer's premises.

The shunting device is fool-proof and without many disadvantages of older methods of by-passing.

Device Is Fool-Proof

The by-pass cannot be operated before removal of the company's seal and meter ring, and the by-pass pull-down tab has a hooked lip for engagement by the sealing ring. As the by-pass is behind the meter and within the mounting box, inadvertent current diversion is impossible.

To operate the shunt, a meter inspector needs only a screwdriver and can dispense with special accessories or jumpers.

When the by-pass is manually operated, the meterman knows that its positive action has left service uninterrupted. The shunt cannot fail. It is interchangeable with the interior parts of other meter sockets not containing by-passing means. Accordingly, the company can easily switch from residential to commercial service, or back again, as the need may be, and it gains this facility for only the basic cost of the device.

Metermen can inspect at any time without regard for the kind of customer, and there is no need for him to make appointments or to repeat his calls.

The device has been submitted by The Murray Manufacturing Co to Underwriters' Laboratories for approval.

(*More How To on page* 60)

A General Electric
Voltage Regulator Engineer Asks...

WHY UNTANK IT AT ALL?

By D. D. MacCarthy

Manager—Engineering
Voltage Regulator Product Section
General Electric Company

One very important point has been left out of recent discussions on "ease of regulator untanking":

On the average, the General Electric ML-32 step voltage regulator doesn't have to be untanked at all until after 20 to 25 years of service.

This point, I think, is important because it tends to put this "ease of untanking" feature in its proper perspective.

Whereas we design the ML-32 to be reasonably easy to untank, this is not our primary interest. We believe that a regulator should be on the line "open for business" rather than off the line "open for repairs."

Here are six of the many *exclusive* G-E features we build into the ML-32 to make untanking a seldom-needed thing:

1. *Tap Leads* are brought directly to the tap switch, thus eliminating about 20 connections in the power circuit.

2. *Internal Thyrite* by-pass resistor* is closely coordinated with series winding insulation for maximum protection. Since it is an *internal* by-pass it is not subject to external damage.

3. *Switch insulation strike and creep distances* are more conservative than other regulators. Moreover . . .

4. *Electrostatic shielding* prevents excessive carbon accumulation at critical points on insulating panels. This means long insulation life, even in carbonized oil.

5. *Optimum-life switching*, with speed controlled by impeller, gives extra-long switch life. Arconite switch contacts are of ample size for long life.

G.E.'s ML-32 is designed for 20 to 25 years of dependable, on-the-line service.

6. *Spring-driven Geneva-gear switch drive* has the simplest construction of any regulator. This means fewer parts to cause trouble.

As a further testimonial to the ML-32's mechanical and electrical strength, G.E. is, to my knowledge, the only manufacturer who guarantees a successful tap change under short circuits—including a guarantee of withstanding short-circuit forces at all load-bonus positions.

So, although I agree it's a good thing to take a regulator apart every couple of decades, I still ask: "Until then, why untank it at all?"

For more information, write Section 423-20, General Electric Co., Schenectady 5, N.Y., or contact your General Electric sales office or agent.

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QUESTION:

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ANSWER:

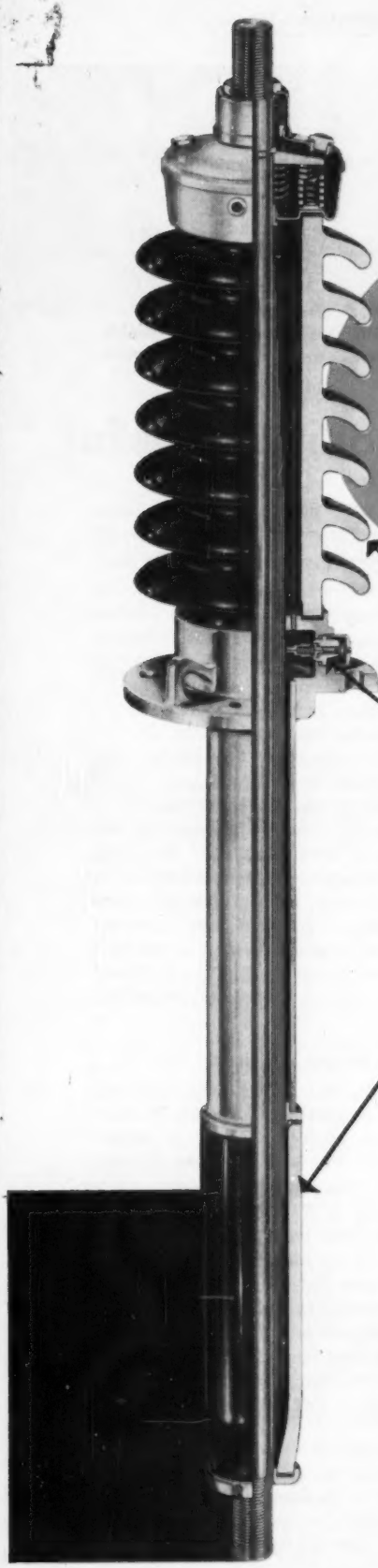
WET PROCESS ELECTRICAL PORCELAIN

Porcelain is inorganic, non-deteriorating and rugged. At high operating voltages, it can withstand leakage currents without tracking, and without permanent damage to its surface.

Lapp

POC* BUSHING

*PAPER-OIL CONDENSER TYPE
TOTALLY-ENCLOSED CORE
ASA STANDARD



IN LAPP POC* BUSHING DESIGN

PORCELAIN does 3 big jobs

1. WEATHER CASING of porcelain provides flashover distance . . . protects insulated core from moisture and weather . . . and with Lapp Fog-Type corrugations provides most-effective surface to withstand leakage currents under atmospheric contamination.

2. POWER FACTOR TAP is insulated by porcelain; provides permanent uniform insulation . . . assures reliability of power factor test readings.

3. SHANK of porcelain encloses paper-oil core, isolates it from oil in the tank. It has a non-tracking, non-deteriorating surface which will withstand leakage currents which arise from contamination of circuit breaker or transformer oil. Makes storage of spare bushings easy, too, because porcelain shank requires no protection from natural elements.

Lapp Insulator Co., Inc., LeRoy, New York

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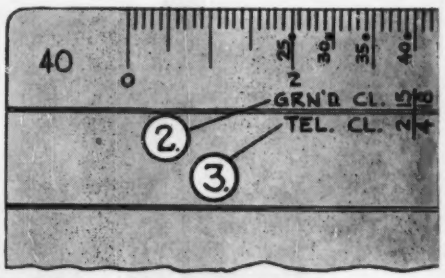


ENGINEER SCALE shows pole heights above ground (1), two ground

Modify Scale for

D. J. THOMPSON, JR, Senior Draftsman, Appalachian Electric Power Co, Lynchburg, Va.

Additional calibrations on an ordinary engineer's scale reduce caculations and reference to charts, graphs, and tables in many determinations of pole height for proper clearance from ground, roads, and telephone lines.

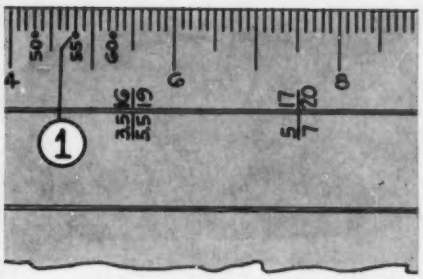
The modified "40" scale illustrated can be used with most profile drawings plotted to the scales of 1 in. = 200 ft horizontally and 1 in. = 40 ft vertically. The usual scale reads vertical measurements in tens of feet, each graduation representing 1 ft. It reads horizontal measurements, however, in hundreds of feet when markings are divided by 2, each graduation representing 5 ft.

Pole Height Indicated

Scale (1) shows dots indicating pole heights above ground level for 20 to 60-ft poles set at normal depth. For example, dot 35 indicates that the pole height above ground is 29 ft. Hence, when the scale with its zero end upward is laid on a profile drawing so that the dot for the selected pole height (overall) is on the profile at the proposed pole site, the conductor positions may be easily scaled from the zero end (or pole top).

Clearances for Heavy Loading

Scale (2) shows two basic ground clearances for the "heavy loading" district. It shows also the clearances required for span lengths exceeding 175 ft, ready for use without further



clearances for heavy loading (2), and wire crossing clearances (3)

Pole Heights

computations. For other conditions, these scale calibrations should be based on National Electrical Safety Code, Section 232, Table 1, and the related comments regarding increased clearances.

Shows Basic Clearances

Ground clearance must increase 1 ft for every 100-ft increase of span beyond the basic 175-ft span with heavy loading. Thus a 275-ft span requires 16-ft clearances where neutral wires cross over areas accessible to pedestrians only and 19 ft where neutral wires cross public streets, alleys, or roads.

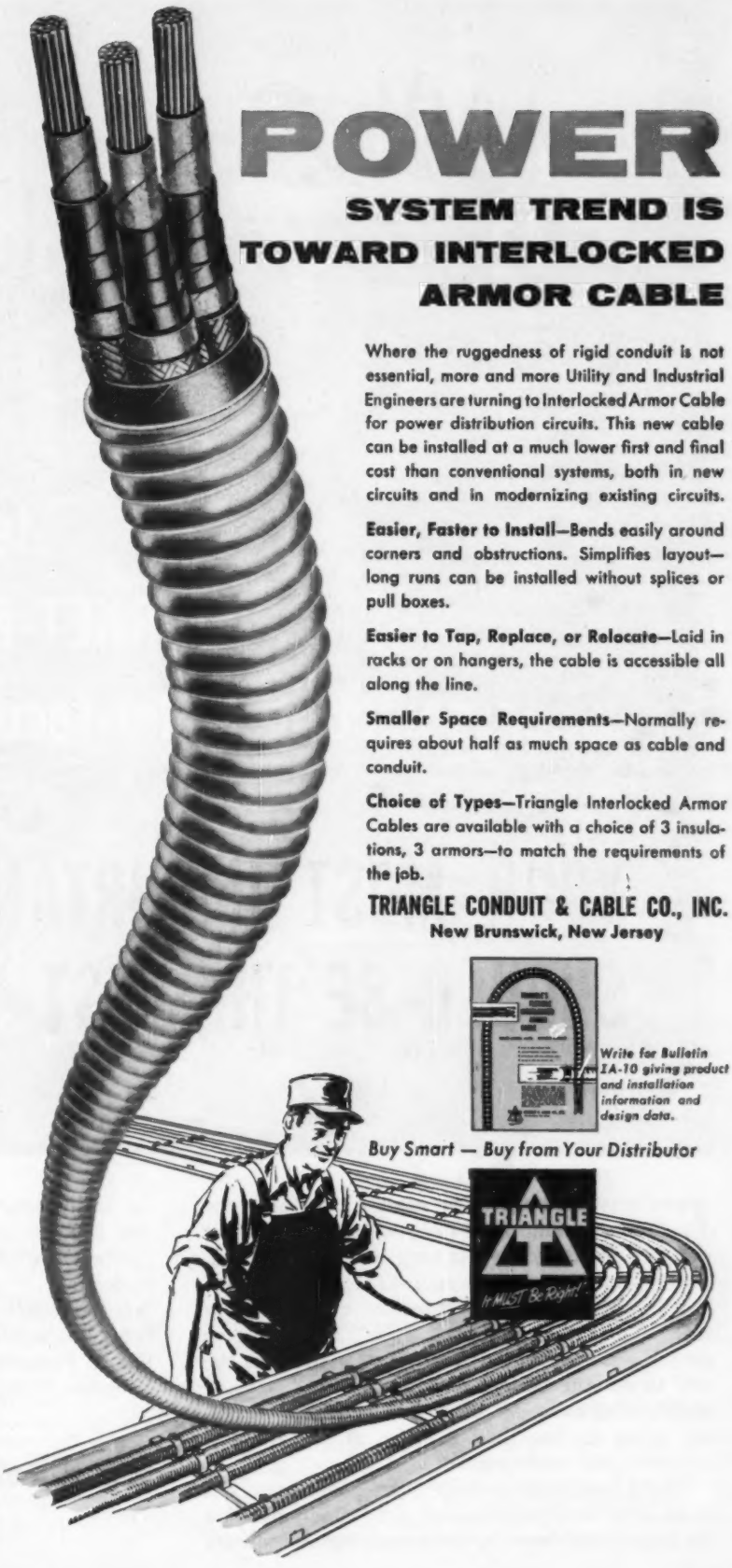
Scale (3) shows two basic clearances over wire crossings and is also based on heavy-loading conditions in the Lynchburg District and the fact that most conductors are in the NESC "large-conductor" class. For other conditions, these calibrations should be based on NESC Section 233 A, Table 3 and related comments on increased clearances.

Values Interpolated

In the case cited, clearance over wire crossings must increase at the minimum rate of 1.5 ft for every 100-ft increase of span beyond the basic 175 ft. Hence a neutral conductor in a 275-ft span requires 3.5-ft clearance above open wires up to 8,700 v and 5.5 ft above communication lines.

For spans intermediate between those calibrated, clearance values are interpolated or calculated. The modified scale does not take into

(*More How To on page 65*)



POWER

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Smaller Space Requirements—Normally requires about half as much space as cable and conduit.

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New Brunswick, New Jersey

Write for Bulletin IA-10 giving product and installation information and design data.

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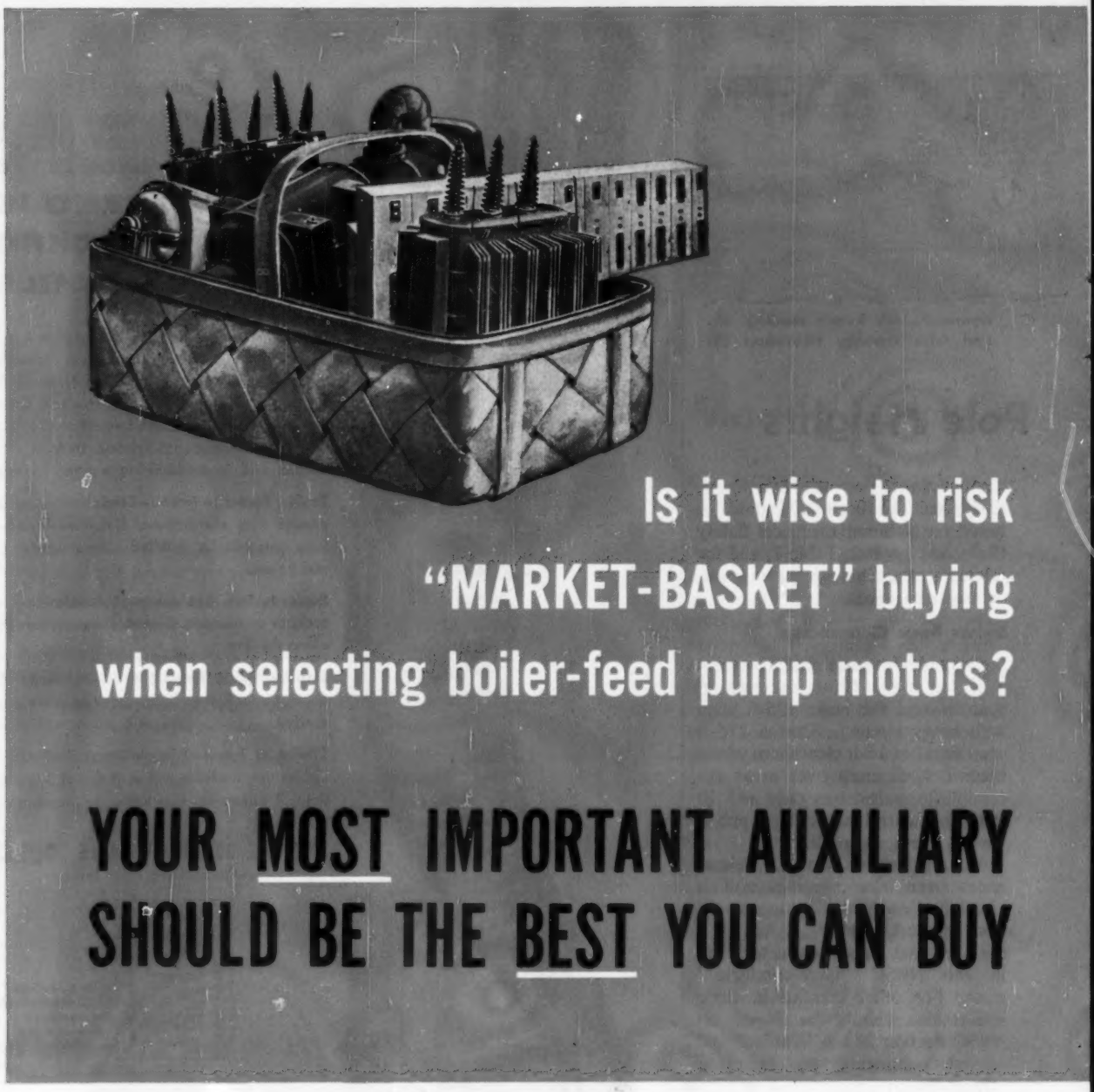
Is it wise to risk
"MARKET-BASKET" buying
when selecting boiler-feed pump motors?
YOUR MOST IMPORTANT AUXILIARY
SHOULD BE THE BEST YOU CAN BUY

Just any large motor won't do. Since the boiler-feed pump motor is your most important auxiliary, it should be the very best you can find. That's why it pays to ask yourself . . . does "unified responsibility" (or market-basket buying) really assure me of the best units? . . . will this plan give me the *best* large motor I can buy? . . . is this the way to get the best engineered drive? . . . *am I really getting a bargain* if my most important auxiliary gives me less than the best in long life and uninterrupted performance?

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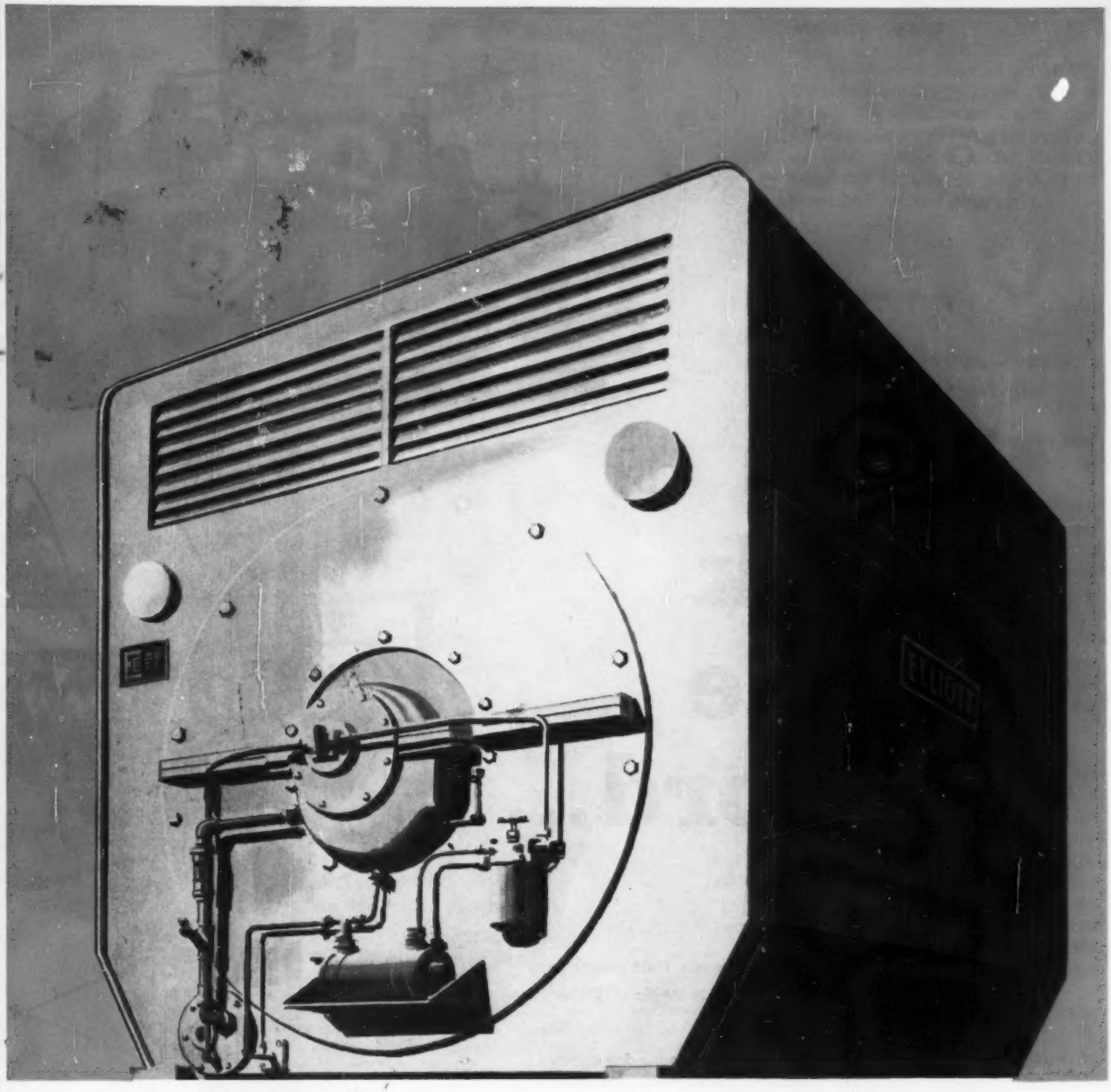
ELLIOTT Company



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The men in your company who are most thoroughly familiar with boiler-feed pump motors know how to recognize the design and construction features that contribute to long life and dependable trouble-free operation. Ask them if they recommend buying by the "market-basket" system . . . or from a specialist. Ask them "Who builds the *best* powerhouse motors?"

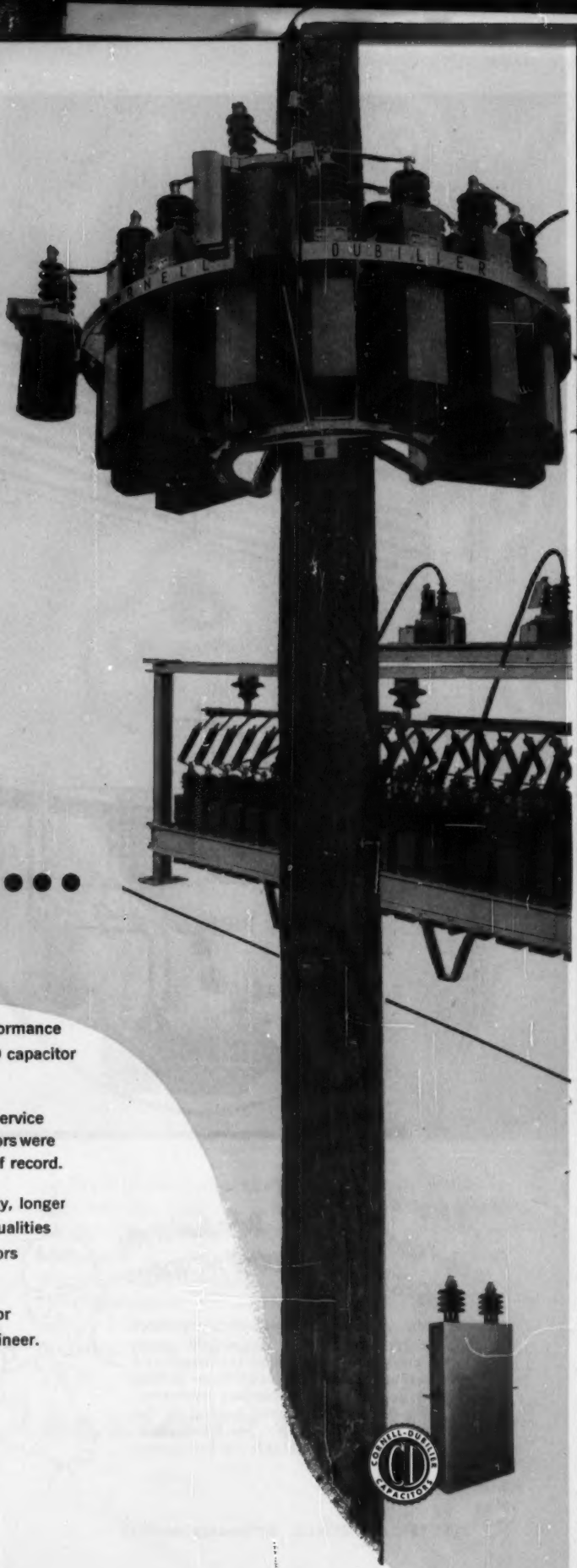
SPECIALISTS for 50 years

Elliott built the world's first large 2-pole motor in 1916. And over the years since then Elliott has specialized in large squirrel-cage induction motors which have established outstanding operating records.

PACEMAKERS in advanced designs

Elliott has consistently pioneered in new and advanced large motor designs—all "firsts" in the industry. And today, Elliott has either built or is building 39 of the largest 2-pole motors ever built . . . 11 motors, each 4500 hp . . . 24 motors, each 5000 hp . . . 4 motors, each 6000 hp.

RS-2



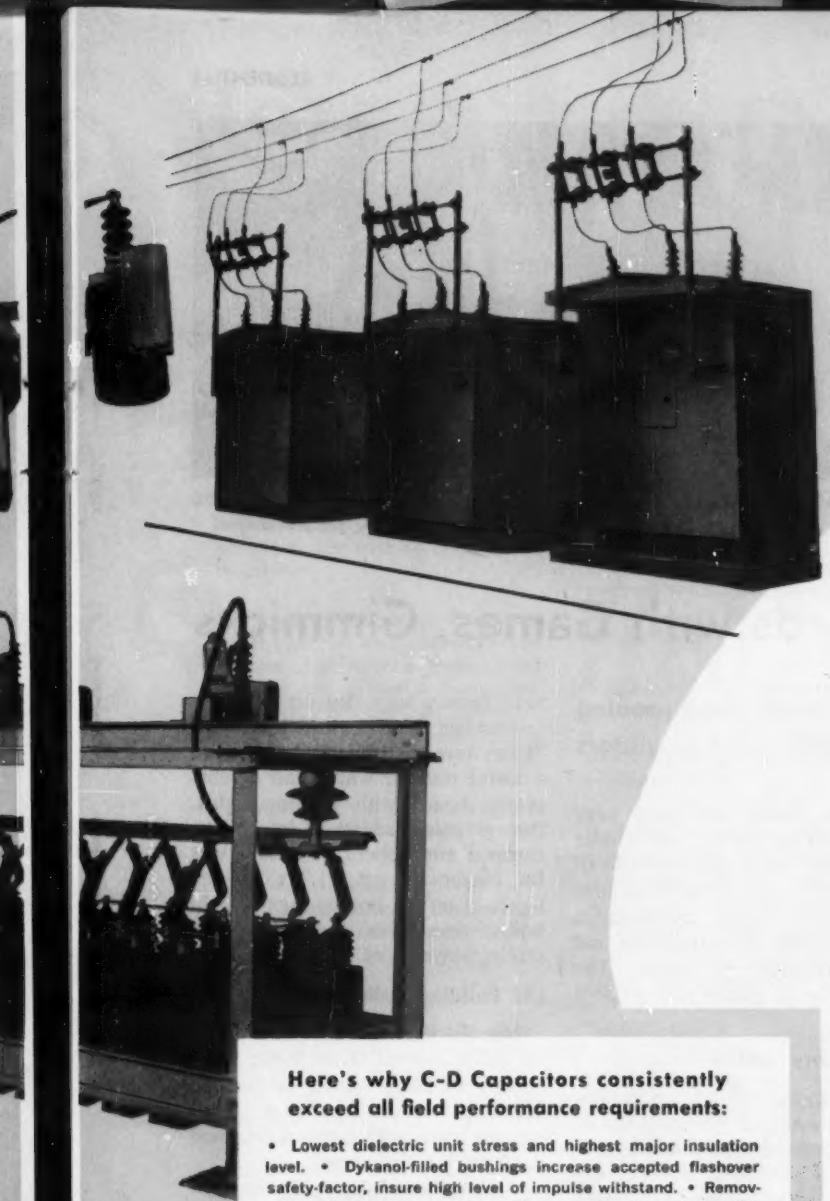
Let's look at the record...

HERE'S A SIMPLE, UNADORNED, PROVEN STATISTIC: Field performance records show 99.6% trouble-free service since the first C-D capacitor was shipped out over 20 years ago.

What's more, even 20 years of continuous, 24-hour-a-day service from C-D capacitors is normal. The first C-D pole-type capacitors were installed in 1936 . . . are still on the job. This is a matter of record.

When you install C-D capacitors you install safety, reliability, longer trouble-free life. C-D capacitors demonstrate their unique qualities where they count . . . in performance, because C-D capacitors are "Best by Field Test."

Insure low-maintenance service from your next power-factor capacitor installation, by talking it over first with a C-D engineer. Just write Cornell-Dubilier Electric Corporation, Dept. D-87 South Plainfield, New Jersey.



Here's why C-D Capacitors consistently exceed all field performance requirements:

• Lowest dielectric unit stress and highest major insulation level. • Dykanol-filled bushings increase accepted flashover safety-factor, insure high level of impulse withstand. • Removable solderless connectors. • Many sections in series-parallel connection. Extremely low voltage gradient per section; less heating; no corona; longer life; lower power-factor. • Discharge resistor connected to each series section, instead of terminal to terminal. Provides effective discharge for each series group and balanced voltage distribution. • Side mounted lifting lugs—stronger and avoid risk of flashover. • Energization tested, 100 percent, to assure uniform distribution of low dielectric losses.

CORNELL-DUBILIER

consistently dependable

power-factor capacitors

SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER & CAMBRIDGE, MASS.; PROVIDENCE & HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD, FUQUAY SPRINGS & VARINA, N. C.; VENICE, CALIF.; & SUB.: THE RADIART CORP., CLEVELAND, OHIO; CORNELL-DUBILIER ELECTRIC INTERNATIONAL, N. Y.

Modify Scale

(*Continued from page* 61)
consideration the point on a span at which the clearances are needed. Changes are also needed for medium or light-loading districts. Calibrations can be marked with a sharp point and colored differently.

GENERATION—Design

Aluminum Tubes, Sheets Cut Cost by One-Third

T. E. BYERLEY, Engineer, Engineering Dept, Georgia Power Co, Atlanta, Ga.

Aluminum tubes and tube sheets will be installed in two heat exchangers cooled by salt water at Georgia Power Co's Plant McManus. Use of aluminum will reduce the initial installed cost by nearly a third. It is hoped that the aluminum tubes and sheets will provide resistance to salt-water corrosion comparable to that of more expensive materials.

The heat exchangers will be used for all service water cooling except condensing. Fresh water from a deep well will be circulated through the heat exchanger and will be distributed through a closed piping system to oil coolers, fan and pump bearings, etc. Cooling water for the heat exchangers will be the same as that used for condensing and will be obtained from a tidal stream near the ocean.

Tubes will be 3S-H14 aluminum, 1 in. OD, 18 BWG, and 21 ft, 11 in. long. Tube sheets will be made of 4S-F aluminum. Tubes and sheets will be installed in two two-pass heat exchangers; one for operation, one for stand-by. Each heat exchanger will have capacity to provide cooling water for the existing 40-Mw unit 1 and the new 75-Mw unit 2 under construction.

Each heat exchanger, equipped with 1,415 aluminum tubes, will have an effective cooling surface of 7,960 sq ft. Fresh water will be pumped though the operating heat exchanger and closed piping system at 3,300 gpm, and salt water for cooling will be pumped at 10,000 gpm.

REDDY'S GAME, a modified version of Bingo, was one of the most popular of Kansas Power & Light's attractions at this year's Topeka Free Fair. Game helped pull some 174,000 total fair visitors and more than 60,000 people played it

KP&L Pulls Fair Crowds with Games, Gimmicks

Kansas Power & Light Co uses modified Bingo, mind reading and 'Housepower Roulette' to woo Topeka Free Fair visitors

How do you draw huge crowds to a commercial fair and then keep them there long enough to visit your booths and listen to your pitches?

Kansas Power & Light Co pulled off the feat neatly this fall at the annual Topeka Free Fair. KP&L figures 174,000 Kansans poured through its "Live Better Electrically Building" during the six-day event. Here's how it was done:

A Bingo Variation

KP&L's new business department devised a variation on the ever popular game of Bingo. Called "Reddy", it worked like this: Visitors had to make "Reddy" on their scorecards just as they would have to make "Bingo" in a regular game. The announcer called the letters thusly: "Under R, Reddy will play your radio for 40 hrs for 5¢," or "Under E, electricity takes the cook out of cooking." For each of the 50 squares on the Reddy Board, visitors got a similar message. Pin-up lamps and bulbs were given as prizes. The game's draw at Fair's end: 60,000 players.

Extra-Sensory Selling

The Topeka utility had a few other tricks up its sleeve. One of the most popular was a mind-reading act and a demonstration of extrasensory perception. This was spliced with a sales message on the company's new rate for the all-electric home and electric water heating. The general feeling was that the seance really dressed up what might have been a very dry presentation.

Another big attraction was "Housepower Roulette." Using a colorful roulette wheel and a four-player board with flashing lights, this gimmick added a lot to the carnival atmosphere. The idea was for players to get all six flashing lights lit on his board. Again, light bulbs were given as prizes. Naturally, players got a sales message.

LBE Building Pulled Too

Not the least of the KP&L drawing cards was the "Live Better Electrically Building" itself. Actually a permanent Home Appliance Building, the utility rented it and renamed it. A few of its features:

- Coordinated appliance displays.
- Manufacturer displays, many of them featuring unusual motifs.
- Garden lighting displays, with one featuring a real lawn, brick patio, flowers and shrubs.
- Live TV broadcasts. Five days during the Fair local TV cameras clicked away at KP&L men interviewing visitors, explaining LBE booths, and giving news and weather.

The entire fair promotion was sparked by intensive advertising and publicity efforts. Releases—and they went to all media—were kept newsy. (According to the utility, none were sent out that did not contain at least one newsworthy item.) The utility's regular radio and TV spots were filled by Fair messages.

LIVE TV SHOWS, broadcast from booths, helped pull heavy crowds. Here a KP&L man and an appliance manufacturer's salesman interview a fair visitor

(*More Selling on page* 68)

No. 1 in a series

Right off the Wire

An all-electronic telephone exchange (said to be the first for commercial use) has no moving parts, is noiseless and can be used in explosive atmospheres. It includes a "memory" which will hold an incoming call.

Wire can be strung beside a railroad track by a new travelling crane at the rate of 60,000 feet per hour.

Simplex recently completed one of the largest and heaviest shipments of cable ever transported on one reel — nearly two miles of ANHYDREX XX insulated submarine cable weighing 60 tons.

A new rubber-like material is porous, but will contain liquids.

Boron, lithium, hydrogen peroxide and fluorine compounds are to be the fuels of a new bomber reported to be in the design stage.

Smog-causing chemicals from automobile exhausts can be eliminated by a chemical catalyst developed by an automobile manufacturer.

Improvements in the explosive rivet have made it noiseless.

Only the touch of a hand is needed to light a new lamp. The electricity in the hand does the work.

Thorium is about three times as plentiful as uranium. A new process for the production of reactor-grade thorium should lead to a reduction in the cost of atomic fuel.

A high-output ultraviolet lamp, for heating and air-conditioning ducts, is claimed to be 1,000 times more effective in killing viruses and bacteria than an equal amount of radiation from the sun.

The world's largest solar furnace is to be completed in 1959. It will produce temperatures as high as 8,000°F, which is about 70% of the temperature of the sun's surface.

An ultra-hard glass has been developed that retains its hardness up to 1508°F.

The cost of converting sea water to fresh water has been reduced from $1.50 to 60 cents per thousand gallons.

"Talk-back TV", a new advance in educational television, enables a pupil to ask questions of a teacher who is broadcasting from a distant room.

Scientists have been able to produce shock waves with speeds of more than 100,000 mph (above Mach 150) involving temperatures higher than 100,000°F.

Some 1958 automobiles are using aluminum instead of copper in battery cables.

The first deep sea telephone cables to utilize the revolutionary new Bell Laboratory vacuum tube repeaters were manufactured by Simplex. Minimum tube life is expected to be 20 years.

Danish trawlers are using nylon propellers. The four-foot, three-bladed size weighs only seventeen pounds and they reduce vibration, resist impact damage and corrosion.

A cell that generates electricity by the chemical action of oxygen and hydrogen has been announced. It avoids some of the disadvantages of both dry cells and storage batteries.

An airplane has been built which can change its shape while in flight for the purpose of testing aerodynamic configurations.

C-L-X (Sealex) is the name of a new, completely sealed, corrugated metallic cable sheath manufactured by Simplex. It is pliable, moistureproof, and permits cable engineers to select the most economical cable cores, while assuring the greatest mechanical protection available.

Observations of the aurora during the Geophysical Year show that it occurs simultaneously at both the North and South Poles. This definitely identifies it with the earth's magnetic field.

A miniature battery about the size of a paper clip is said to deliver a steady flow of current for 176,000 hours.

Shirtsleeve Service

Simplex recently completed an order for 4600 ft. of Anhydrex XX Parkway Cable. The Simplex man was on the spot to help with installation, which happened to be on a 9,500 ft. mountain in rough terrain. He helped design a reel mounting bracket (for holding up to 7200 lbs.) for the front of the tractor used for laying. He supervised the laying of two lengths 2200 feet long.

This case typifies the kind of cooperation that Simplex offers in order to assure correct installation and satisfactory service.

SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

Simplex

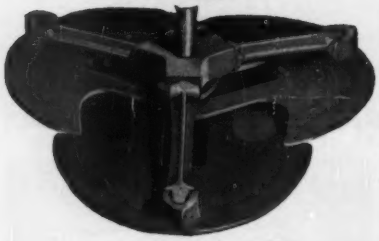
Highest quality cables for: Mining
Power & Lighting • Construction
Transportation • Communications
Signalling

See us at Booth 1124 Plant Maintenance & Engineering Show, Chicago

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
FAIRFIELD, IOWA

Salesmen's Seminar Subject: Electric Heat

Commonwealth Edison Co, Chicago, recently held a school for power salesmen in electric heating. To prepare them for giving help to customers, the company brought in 20 residential and power salesmen from its territory to attend a four-day seminar on electric space heating and heat pumps.

The group in the photo is shown getting a lesson in heat pump fundamentals. In addition to instruction on other types of equipment, the salesmen listened to lectures on wiring, controls, insulation, heat loss calculations, and heating requirements.

Manufacturers cooperated by furnishing exhibits and instructors.

REA Issues Bulletin on Electric Heating

The Rural Electrification Administration recently issued REA Bulletin 142-1 entitled "Electric House Heating."

With an introduction that begins, "Electric house heating is rapidly growing in popularity and acceptance," it goes on to discuss the responsibility of the system operator in serving loads, to wit:

"(1) The rural electric system should want and has a utility responsibility to serve whatever loads the consumer desires. This includes electric house heating.

"(2) Through long-range planning the prudent operator has ascertained what his future system may be like and knows what to do, whether the increase comes from house heating, air conditioning, water heaters, or some other load.

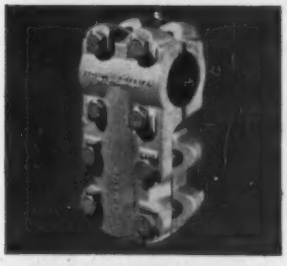
"(3) The system operator obtains facts concerning each particular load, including electric house heating, as it pertains to the effect on, and value to, his own system. He then makes decisions as to investments, operating practices and revenue, based only on these facts."

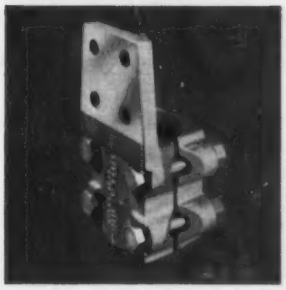
The bulletin describes various equipment, installation requirements and costs, insulation, vapor barriers, and heat loss calculations. A bibliography of electric heating and air conditioning books, articles, publications, and a directory of electric heating equipment manufacturers is included. Another booklet which gives complete details on system demand, diversity, load factor, rates, and other subjects will be published soon. It is REA Bulletin No. 112-5, called "Serving Electric House Heating from Rural Systems."

REA Bulletin 142-1 is available from Government Printing Office, Washington 25, D. C. Price: 15¢.

(*More Selling on page* 70)

EASY INSTALLATION. Bolt heads fall naturally into locking lugs on connector walls, making installation fast and sure with one wrench.





...assured with Delta-Star heavier-duty aluminum connectors

Delta-Star offers you a *complete line* of NEMA-standard aluminum conductor connectors. Their generous overall proportions and their contact surfaces which precisely match those of the conductors help assure maximum contact area and minimum contact resistance. Heavy cast-aluminum walls throughout make these Delta-Star Connectors rugged and immune to distortion under the most rigorous service.

Delta-Star Connectors are supplied in types and sizes to meet all requirements.

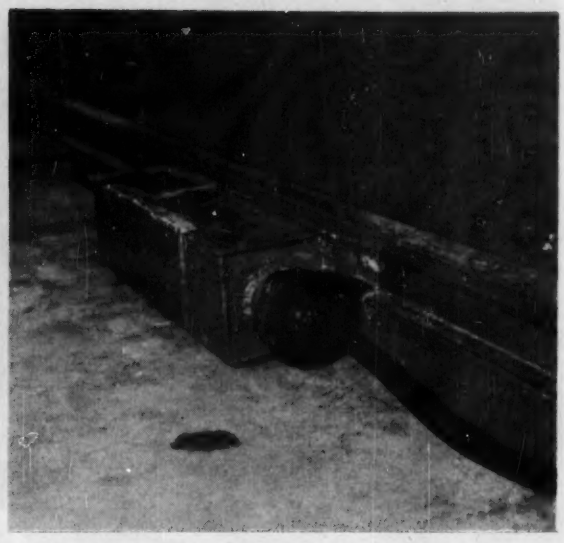
For complete information, write **Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton St., Chicago 12, Illinois. District offices in principal cities.**

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Porter Divisions: Connors Steel, Delta-Star Electric, Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings, H. K. Porter Company (Canada) Ltd.

Tank full of boiling cleanser. . .



with immersion heaters on base. . .

Speeds Cleaning of Printing Press Plates

HARRY FISLER, Power Sales Engineer, Pennsylvania Power & Light Co, Harrisburg, Pa.

Two 5-kw water immersion heaters installed at the J. Horace MacFarland Co, Harrisburg, Pa., have solved a common printing-industry cleaning problem. The heaters and an electric hoist not only elmininate manual labor, but do a better job of removing ink, ink drier, and paper dust that clog the mounting clip holes in Blatchford base plates.

Installed on a 50 x 65 x 6-in. steel tank, the heaters boil an 80-gal. mixture of water and cleanser. The zinc or magnesium alloy plates, which are ¾-in. thick and range up to 48 x 65 inches in size, are lowered into the mixture and positioned by the electric hoist. Bleeding compressed air into the bottom of the tank provides a stirring action which increases the cleaning action and keeps temperature and strength uniform throughout the mixture. Two large size plates can be handled at one time.

Previously, the plates were cleaned in a flat pan filled with gas-heated hot water and cleanser. The plates were scrubbed and turned by hand. Results were generally poor. The new installation was the result of applying principles learned at the Pennsylvania Power & Light Co metal sheath heater course.

Industrial Electrification Council Announces Winners

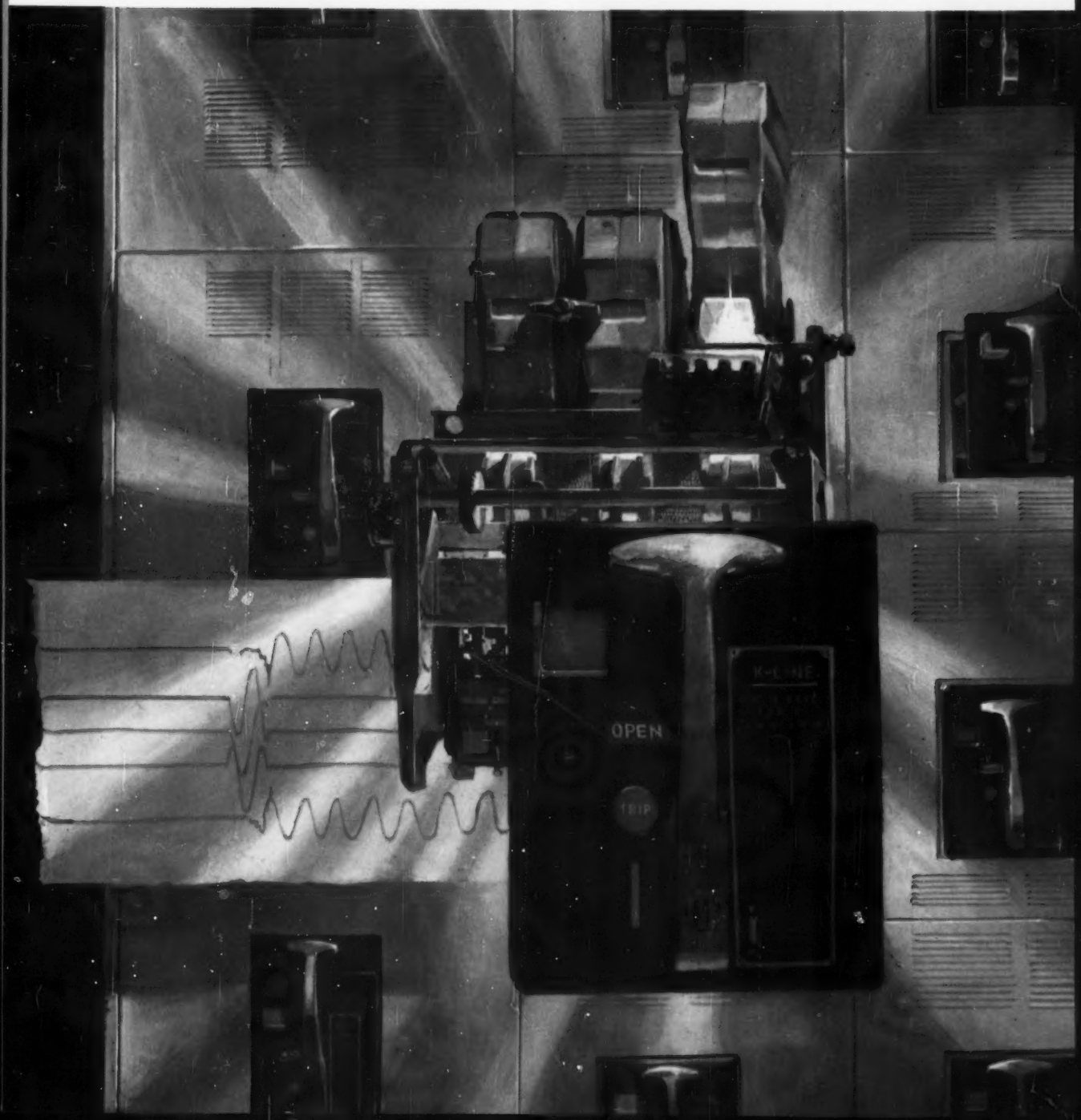
A metal-sheath heater stress-relieving furnace and an electrically heated autoclave for drying glue on aircraft parts were the two top winners in the Industrial Electrification Council's contest, "How I Switched On Electric Heat." The contest was open to all employees of industrial companies who participated in the Metal Sheath Heater Courses sponsored by 39 electric companies throughout the country. A total of $700 in prizes was awarded.

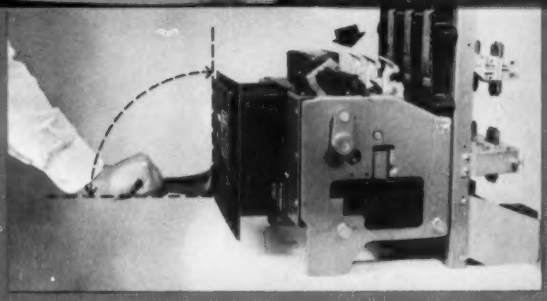
Because the two best entries were exceptional installations, the judges awarded $200 first prizes to E. L. Bandmeier, Emmaus, Pa., who attended the Pennsylvania Power & Light course, and to Walter Romasko, Depew, N. Y., a Niagara Mohawk conferee. The second prize of $100 went to Stephen Nagy for an installation made as a result of information gained at Pennsylvania Electric Co's sessions.

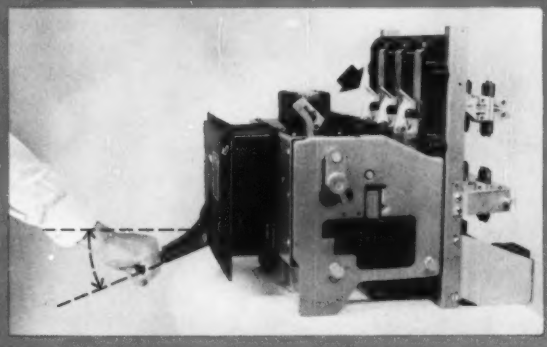
Fifty-dollar prizes were awarded to William B. Magnuson, Paulsboro, N. J. (Atlantic City Electric Co); W. E. Johnson, Marion, Ind. (Indiana & Michigan Electric Co); Francis X. Roddy, Warren, Ohio (Ohio Edison); and Anthony Artino, Cleveland (Cleveland Electric Illuminating Co). Several other entries were cited as exceptional.

In all, 144 entries were received. Installations were evaluated on the basis of originality, ingenuity, and proper application. The contest closed Nov. 30, 1957. Awards will be presented by the utilities who serve the prizewinners' companies.

I-T-E new K-Line of low voltage switchgear represents the first major advance in this type of equipment in 13 years. This completely new design offers greatly increased safety and operating efficiency, is available in three frame size ratings: 225, 600 and 1600 amp continuous at 600 v alternating current.







Quick-make closure of contacts on manually operated circuit breakers is provided by spring action. The first 90% of the pulldown handle travel loads the springs, the last 10% releases the stored energy and closes the contacts. No teasing is possible.

I-T-E announces sweeping design advances in new line of low voltage power circuit breakers and switchgear

- First quick-make closure of contacts
- First closed-door racking of circuit breakers to any position
- First expanded range overcurrent trip device
- 4-high stacking of 600 amp frame size circuit breakers
- Subassembly construction of circuit breakers & accessories

Quick-make manual closure eliminates damaging arcing, greatly increases life of contacts and circuit breaker—contacts cannot be teased together, breaker cannot be destroyed by careless closing against a major fault.

Quick-make closure, formerly available only on electrically operated circuit breakers, now is a standard feature of all manually operated breakers in the new I-T-E K-Line.

A manually charged stored energy mechanism, powerful enough to close the contacts safely against a full short circuit, provides the manual quick-make action. The first 90% of travel of the new pulldown handle charges a set of springs, the last 10% of travel releases the stored energy and closes the contacts—breaker life and operator safety do not depend on the brawn and brain of the operator. Contacts cannot be teased together, the closing action is fast and positive.

Electrically operated models in the K-Line have an actuating motor in addition to the basic mechanism. This motor-driven, stored energy system requires only 10 amp from a simple power source, compared to as much as 160 amp by comparable solenoid mechanisms. Energy for closing is prestored by the new K-Line circuit breakers in 2 seconds. Closing time is 5 cycles.

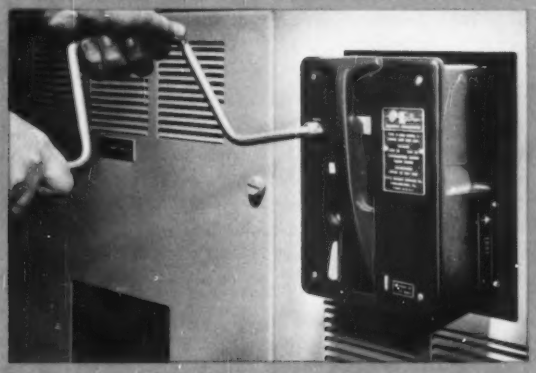
Closed-door drawout keeps circuit breakers clean and aisles uncluttered, promotes operator safety

This exclusive I-T-E feature permits racking of breaker into connected, test and disconnected positions without opening the door of the breaker compartment. It facilitates inspection, testing and maintenance. Blocked circuits are easy to identify. It keeps circuit breakers clean even in dust and dirt-laden atmospheres. It keeps aisles uncluttered and clear of compartment doors. It promotes personnel safety.

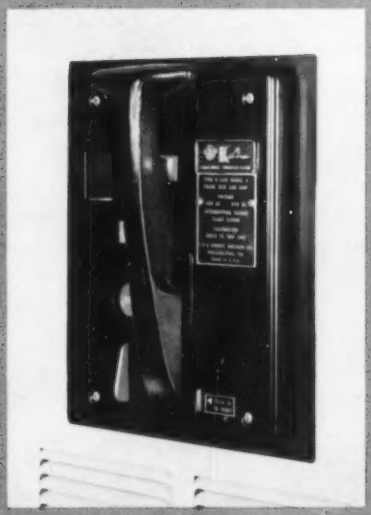
A lift shutter, which permits insertion of the racking crank that moves the breaker, can be padlocked in connected, test or disconnected position to guarantee complete safety. This shutter cannot be lifted while the circuit breaker is closed. Interlocking also prevents closing of the breaker while the shutter is lifted.

The extendible escutcheon slides through the compartment door while a dust seal surrounding the escutcheon is held in place by the door.

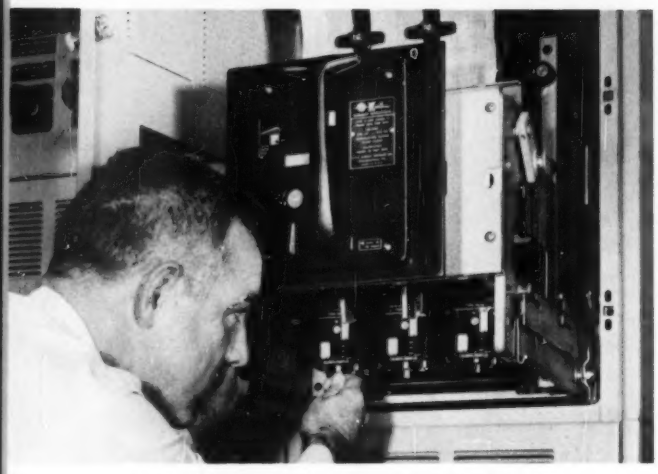
In addition to affording closed-door drawout, the new K-Line of switchgear is smaller than any comparable design. The reduced size of the circuit breakers permits 4-high stacking of 600 amp breakers. And unitized construction reduces the switchgear to three basic components —the breaker, the enclosure, and a cradle on which the circuit breaker rolls for drawout.



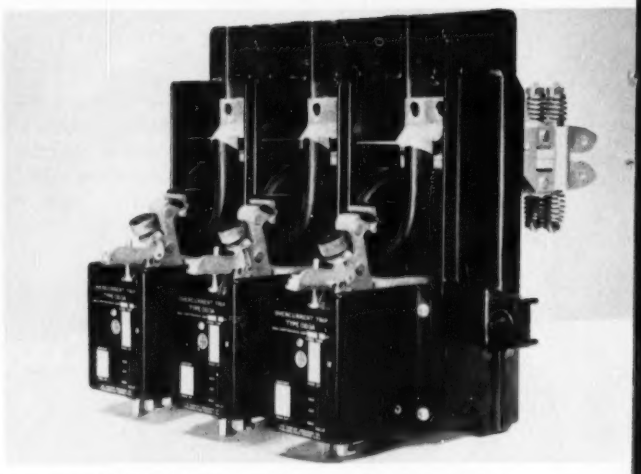
Exclusive closed-door drawout is illustrated in this series of photographs. Photo 1 shows shutter lifted and racking crank inserted. Photo 2 shows circuit breaker in connected position. Photo 3 shows breaker in test position. Photo 4 shows breaker in disconnected position.



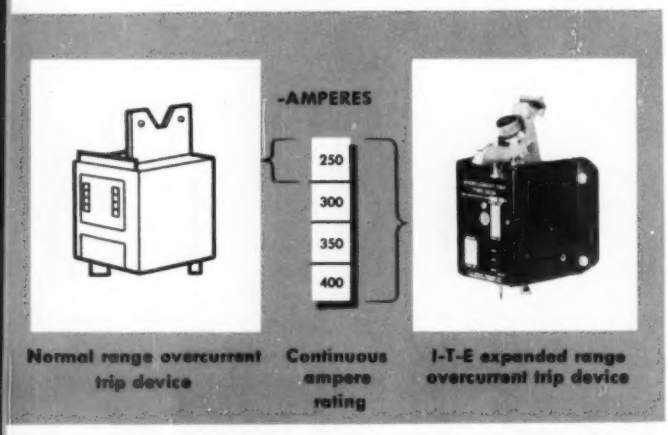
New overcurrent trip arrangement permits use of each trip over wider range of continuous load conditions



Accessible trips, on both manual and electrical types, provide new ease of adjustment. Adjustment, a difficult job at best on previous electrical types, can now be made in a matter of seconds.



Common molding holds all three trips for this 600 amp K-Line circuit breaker. Can be replaced in a fraction of time required for changing the individual trips on comparable lines.



This table indicates a sample grouping of ratings for the new K-Line circuit breakers. Only 9 trip units now cover the range of continuous current ratings as against 23 formerly required.

Trip flexibility is an important feature of the K-Line. Only 9 trip units now cover the complete range of continuous current ratings—15 to 1600 amp—as against 23 formerly required. Last-minute changes in load capacity can be satisfied in many instances with the existing trip unit as a result of the expanded range of trip settings.

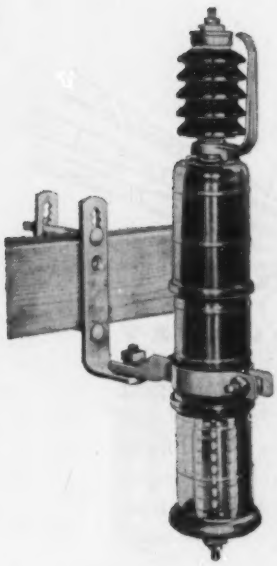
This feature, plus easy adjustment of trip devices and quick change in the field, is particularly significant in meeting constantly expanding load requirements. Trip units are mounted on a one-piece base. Trip units are changed from the rear and in a fraction of the time formerly required.

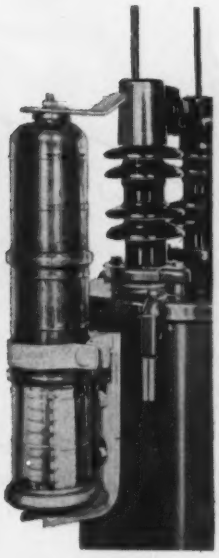
For the complete story of the I-T-E K-Line of circuit breakers and switchgear, see your local I-T-E representative. Or write us for Bulletin 6004C. I-T-E CIRCUIT BREAKER COMPANY, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

19TH AND HAMILTON STREETS. PHILADELPHIA 30. PENNSYLVANIA

New Equipment





Arresters . . .

. . . combine external gap with electric characteristics of valve and internal-gap construction. The heavy-duty arresters are pyrex-housed and are rated 3, 6, 9, and 10 kv.

For crossarm, pole, and wall mounting, type TX arresters have an external gap insulator. The type T arresters are mounted directly on transformers or regulators. Gaps can withstand normal line operating voltages. Damaged arrester does not cause system fault because external gap prevents line lockout.

Both types of arresters meet AIEE and NEMA Standards.

Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.

Current Transformer . . .

. . . is silicone insulated for indoor metering and relaying applications. Insulation is molded to coil assembly, sealing it from moisture and air, and is unaffected by temperature changes. It also resists abrasion and rough handling.

Rated 8.7 kv with current ratings from 5 to 800 amp, it has rating factor of 1.5 at 30C in ratings from 5:5 to 600:5, and 1.33 for the 800:5 unit. In the 0.3 accuracy class, it meets ASA and NEMA specifications.

Transformers weigh about 25 lb and can be mounted in any position—on wall, column, ceiling, or floor.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Relay Tester . . .

. . . provides phase-angle meter, voltmeter, and connections in compact box. Used as a junction point when an output, variable in phase and magnitude, is required in conjunction with a phase shifter and other equipment.

Rating is 0.2 kva, with input of 115 v, 60 cycles. A 220-v variable autotransformer is used on input for minimum distortion. High and low ranges are provided.

Phase-angle meter is accurate to ±1%, reading 0-360 electrical degrees. Rectifier-type voltmeter is accurate to ±2% with voltage ranges of 0 to 1.5, 15, and 150. It may be used independently of the unit.

The instrument is portable, weighing under 25 lb.

Multi-Amp Corp, 465 Lehigh Ave, Union, N. J.

(*More New Equipment on page* 78)

POWER PORTRAIT

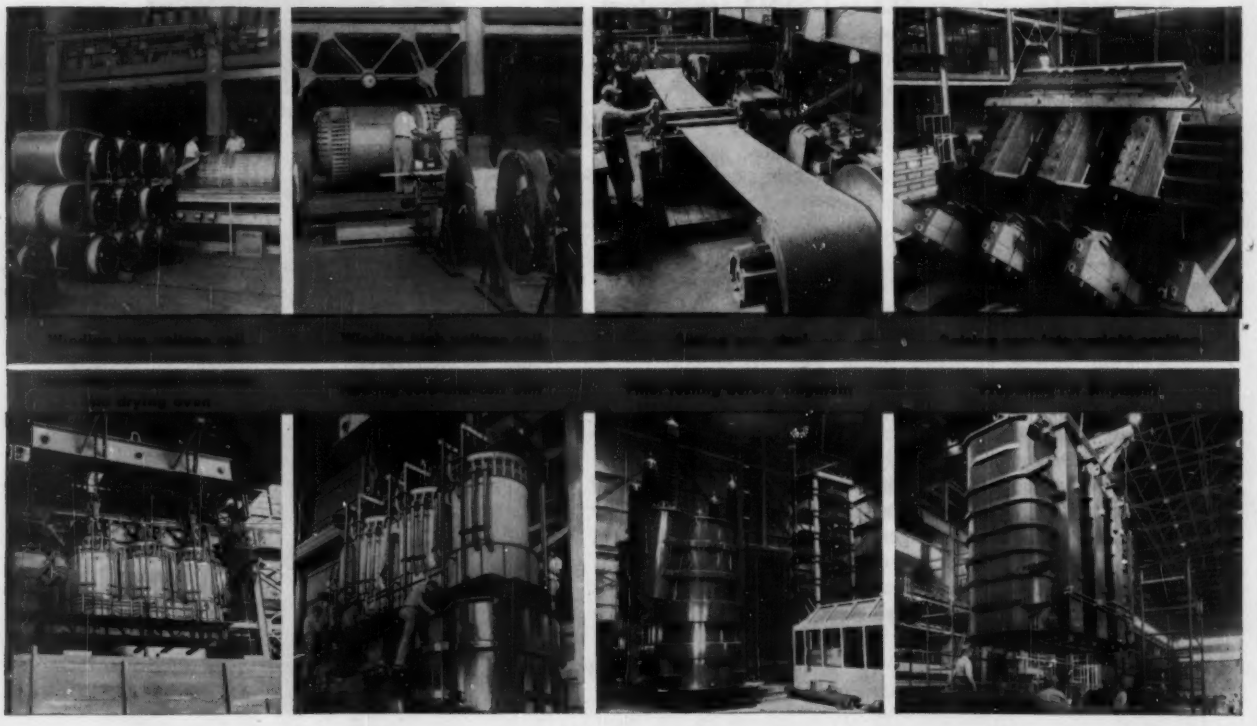
BY MOLONEY

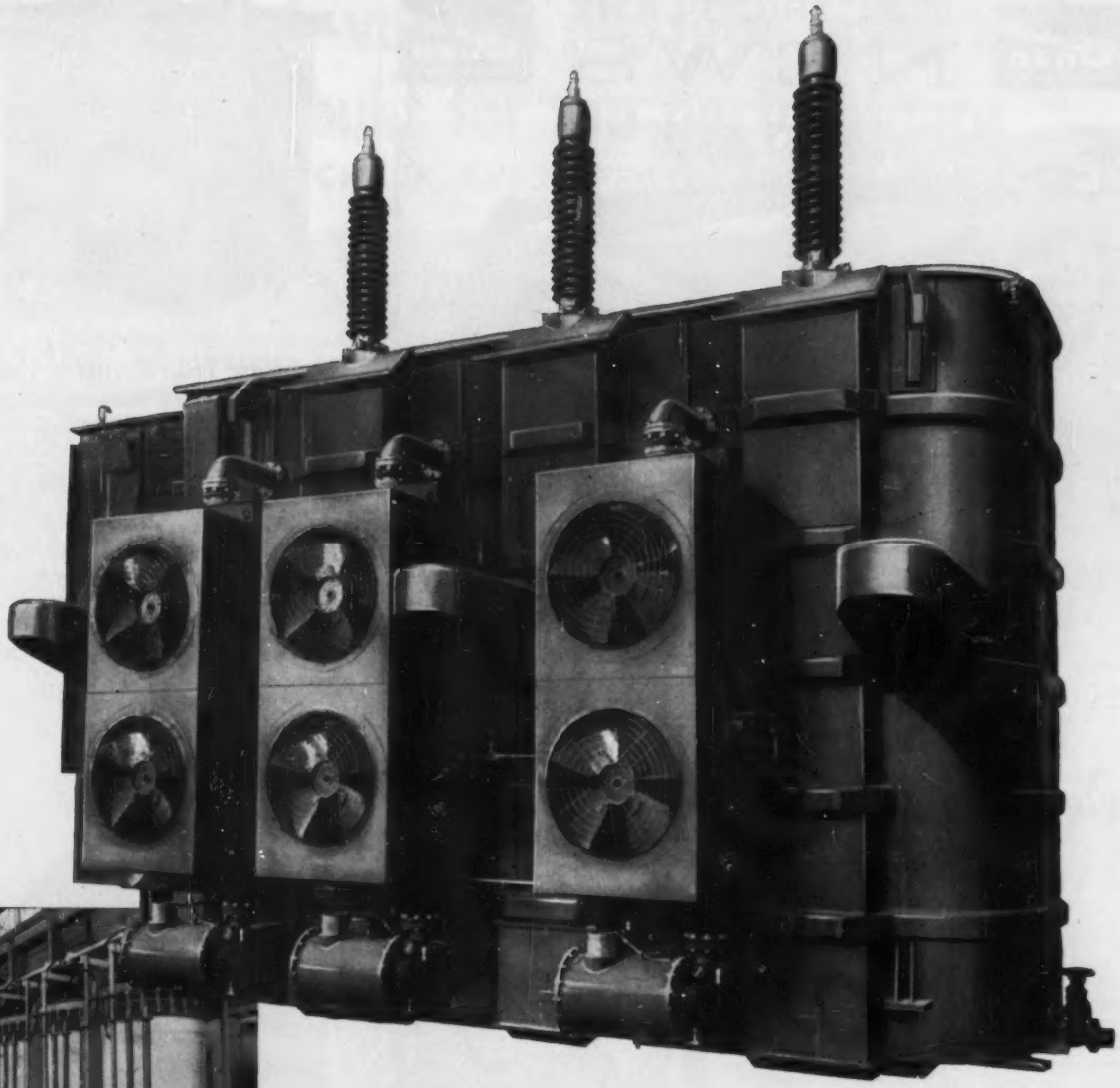
A 100,000 K. V. A., three phase, forced-oil-cooled, load tap changing transformer recently completed by Moloney for the Iowa Power & Light Company. High voltage: 161,000 Grd. Y. volts. Low voltage: 14,400 Delta volts. Equipped with load tap changing equipment to obtain voltages 5% above and 5% below rated high voltage in eight 1¼% steps. All voltages are full capacity.

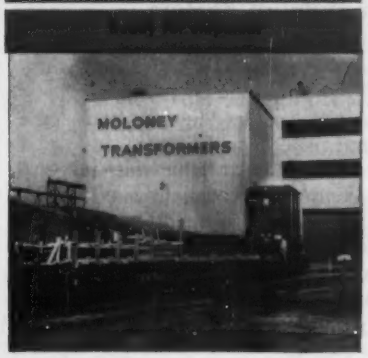
ME57-25

This is the main power transformer for Unit #2 at Iowa Power & Light Company's Council Bluffs Power Station. The transformer will step-up the generated voltage of 14,400 delta volts to the transmission voltage of 161,000 Grd. Y. volts.

Another example of Moloney's ability to design and manufacture transformers of any rating to meet their customers specific requirements.







MOLONEY ELECTRIC ®

MOLONEY ELECTRIC COMPANY

Manufacturers of Transformers for Utilities, Industry and Electronic Applications

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MISSOURI, AND TORONTO, ONT., CANADA

ELECTRIC PLANT
NEWS

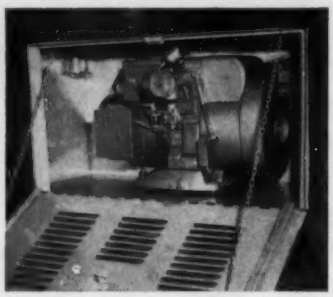
Truck-mounted electric plant cuts costs two ways

Onan Plant provides A.C. power for electric tools and lights, and D.C. output to charge batteries for radio communication.

Utilities using this dual-purpose Onan Electric Plant on trucks report savings ranging from *$2.00 per day* per truck to *$800.00 per year* per truck . . . for the battery-charging feature alone. Before installation of the Onan plant it was necessary to keep the large truck engine running to charge batteries, extremely wasteful from the viewpoint of fuel and engine maintenance.

The Onan plant shown is a Model O7AK, developing 750 watts of A.C. with about 8 amperes for 12-volt battery charging. It is powered by an Onan single-cylinder, air-cooled gasoline engine direct-connected to an Onan all-climate generator in a compact, rigid, long-life unit. A.C. output is sufficient for operation of drills, saws and other tools used for construction and maintenance.

Other vehicular battery charging plants and A.C. models available.



Vacu-Flo cooling system permits enclosed installation

With Onan's Vacu-Flo system, air is drawn (rather than blown) through generator and engine, and discharged through a duct to the outside. An Onan air-cooled plant with Vacu-Flo can be installed in a small compartment within truck or trailer.

Ask your Onan distributor about this dual-purpose unit or write for circular on three battery charging methods.

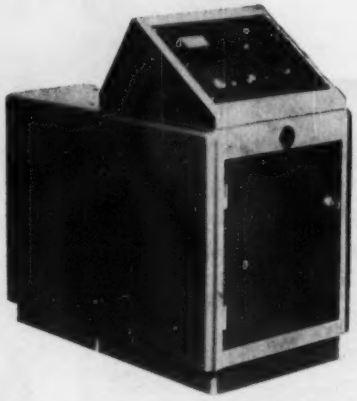
D. W. ONAN & SONS INC.

2820A University Ave. S. E., Minneapolis 14, Minnesota

Lighting Transformers . . .

. . . are light and compact in sizes from 5 to 37.5 kva. Core is wound of grain-oriented, high-permeability, cold-rolled steel which gives low losses and high flux densities.

Large air ducts provide good heat-rise characteristics and high overload protection. The transformers also feature low decibel levels due to construction and mounting. **Marcus Transformer Co, Inc, R&D Section, Rahway, N. J.**



Ac Breakdown Testers . . .

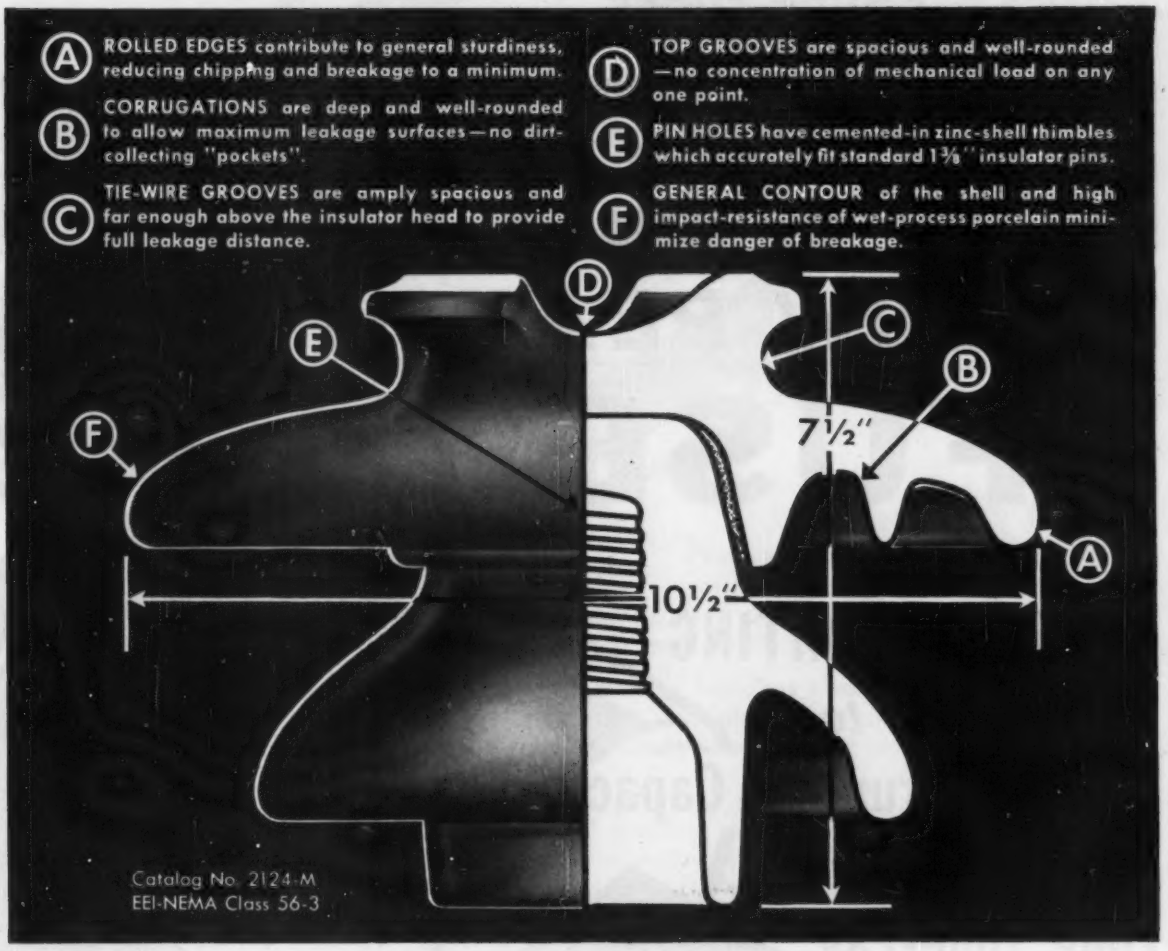
. . . cover high-voltage range from 50 to 100 kv at capacities of 2 and 5 kva. They test motors, generators, line materials, cables, liquids, and insulating materials. Features include continuously variable output voltage control from zero to maximum, and control interlocks for safety to test personnel.

Associated Research, Inc, 3777 W. Belmont Ave, Chicago 18, Ill.

(*More New Equipment on page* 82)

Thomas high-voltage pin-type insulators—quality-built for top performance

CHECK THESE FEATURES


A ROLLED EDGES contribute to general sturdiness, reducing chipping and breakage to a minimum.
B CORRUGATIONS are deep and well-rounded to allow maximum leakage surfaces—no dirt-collecting "pockets".
C TIE-WIRE GROOVES are amply spacious and far enough above the insulator head to provide full leakage distance.
D TOP GROOVES are spacious and well-rounded—no concentration of mechanical load on any one point.
E PIN HOLES have cemented-in zinc-shell thimbles which accurately fit standard 1⅜" insulator pins.
F GENERAL CONTOUR of the shell and high impact-resistance of wet-process porcelain minimize danger of breakage.
7½"
10½"
Catalog No. 2124-M
EEI-NEMA Class 56-3

Shown here is one of the Class 56 of EEI-NEMA high-voltage pin-type insulators made by Thomas Works.

Especially recommended for transmission applications, these insulators embody all the tested and proven refinements of design and construction that assure long service life and superior performance under severest operating conditions.

An added feature: All five Thomas EEI-NEMA High-Voltage Pin-Type Insulators are also available with Thomas "QT" (Quiet-Type) radio treatment at no extra cost.

Physical ruggedness and optimum electrical properties are obvious characteristics of Thomas High-Voltage Pin-Type Insulators. For full information, write *Thomas Works, Delta-Star Electric Division, H. K. Porter Company, Inc., Lisbon, Ohio. Offices in principal cities.*

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings, H. K. Porter Company (Canada) Ltd.

Announcing

another outstanding development soon to be available by the makers of BUSS FUSES

FUSETRON

LOW-PEAK FUSES

Have

CURRENT LIMITING

added to

High Interrupting Capacity

and

Long Time-Lag

Made in all standard sizes above 60 amperes

FUSETRON Low-Peak Fuses are made in all standard sizes above 60 amperes—both 250 and 600 volt ranges.

In 60 amperes and smaller sizes tests show that FUSETRON dual-element fuses have sufficient current limitation to protect circuit and components in all normal cases.

Now you can have a high degree of protection against the thermal and mechanical stresses that heavy fault currents often impose on switches or other circuit components.

FUSETRON Low-Peak Fuses have a current limiting element that cuts off fault current so fast that it cannot build up to a damaging peak.

These new FUSETRON Low-Peak Fuses are built on the same principle as FUSETRON dual-element Fuses. They have:

the same High Interrupting Capacity

the same Time-Lag to hold harmless current surges

PLUS Greater Current Limitation to restrict fault currents to a LOW PEAK

FUSETRON Low-Peak Fuses can be interchanged with FUSETRON dual-element Fuses.

Where their use is required in any part of the electrical system, they can be installed without upsetting proper coordination over the range of useful loads and normal faults.

Hence, their application requires no testing or complicated calculations.

They are designed for use to protect circuits and components that might be damaged by the thermal and mechanical stresses of peak fault currents if other protective devices are used.

If planning new installations, keep FUSETRON Low-Peak Fuses in mind for those locations where peak fault current must be held to a low value.

BUSSMANN MFG. DIVISION

UNIVERSITY AT JEFFERSON, ST. LOUIS 7, MO.

McGRAW EDISON

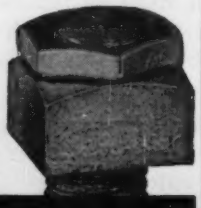
Widely used on

- Insulator Pins
- Crossarm bolts and braces
- Clevises and clamps

- **Eliminate checking and re-tightening**
- **Eliminate radio interference due to loose hardware**

Every bolt - and - nut assembly locked with PALNUT Lock Nuts stays tight, despite weather, wind, stress and vibration. PALNUTS, tightened on top of the regular nuts, prevent loosening and falling off. Very low in cost—easily, speedily applied — require little space — may be used on new or existing assemblies. Hot dip galvanized, silicon bronze and other materials and finishes. Stocked by all leading pole line hardware manufacturers.

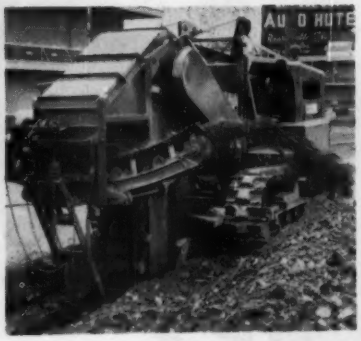
The PALNUT Co.
51 Glen Road
Mountainside
N. J.



PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

Line Hose . . .

. . . made of rubber is safe on lines energized to 15 kv. Hose completely surrounds conductor, has an interior overlap to prevent dislodgement. Extended 2-in. lips provide a grasping space for engagement with clamp- or plier-type tools. The rubber includes a corona-resisting material. Standard lengths are 3, 4½, and 6 ft.
W. H. Salisbury & Co, Morgan & Kinzie Sts, Chicago 22, Ill.



Ditcher . . .

. . . has vertical digging boom which offers maximum digging depth of 7 ft, and bucket widths of 19, 21, and 24 in. The crawler-mounted ditcher features a variable range of forward crowding speeds from 0 to 31 fpm and a 15-fpm reverse. Crowd, brakes, boom hoist, and discharge conveyor are hydraulic. The 8-ft discharge conveyor is driven in either direction at speeds from 250 to 630 fpm.
Barber-Greene Co. 400 N. Highland Ave, Aurora, Ill.

Circuit Tester . . .

. . . has tape programming for taking measurements on electrical equipment. An unskilled worker can operate the push-button device, checking impedance, ac and dc voltage, resistance, leakage, and continuity. Program information is punched into 1-in. paper tape.
California Technical Industries Div of Textron Inc, Old County Rd, Belmont, Calif.

(*More New Products on page* 84)

ATLAS

INDUSTRIAL SAFETY EQUIPMENT
security designed for the job . . .

Safety Belts & Straps, Harnesses, Lanyards, Rope Safety Nets and Ladders, Axes insulated for 20,000 Volts
for: Linesmen, painters, electrical, bridge, construction and marine workers, window cleaners and tree surgeons.
Available in leather and web.
All hardware drop forged, tested.

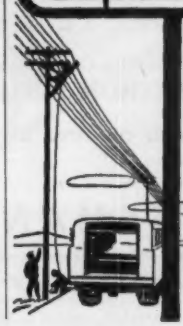
Write for complete literature on our safety equipment line

ATLAS SAFETY EQUIPMENT CO., INC.
177 N. 10th St. Brooklyn 11, N. Y.

INDIANA STEEL & WIRE CO. MUNCIE, IND.
Crapo Galvanized

Signs along the lines of **Crapo GALVANIZED STEEL STRAND PERFORMANCE**

For dependable performance . . . insist upon Crapo Galvanized Steel Strand. Superior tensile strength, combined with long-life, ruggedness and workability, makes Crapo Steel Strand first choice for guys, messenger and overhead ground wire.
The famous Crapo galvanizing process provides dependable protection for the steel, prolongs the expectant life of the strand.



- **Low maintenance cost**
- **Laboratory tested and controlled quality**
- **Meets highest quality standards**
- **A size and grade for all practical needs**
- **Contact your Crapo Jobber Today!**

INDIANA
STEEL & WIRE CO., INC.
Muncie, Indiana

utilities,
or telephone
utility is a Preformed prospect...
the rest are
Preformed customers
In July, 1947, Preformed Line Products Company didn't have a customer; all the electric and telephone utilities were prospects. Today, the situation is almost completely reversed.
For example, in FORTUNE's list of the "Fifty Largest" utilities, only one of the electric and telephone utilities mentioned is still a prospect; all the rest are now Preformed customers. In other words, the Preformed principle of using preformed helical rods for line accessories has gained almost complete acceptance in only 10 years.
If you are among the few utilities not utilizing Preformed, you might ask "Why?". PREFORMED LINE PRODUCTS COMPANY, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland
...in 10 years the leading manufacturer of armor rods, dead-ends, Guy-Grip dead-ends, splices and other line accessories.
PLP
You can look up to Preformed

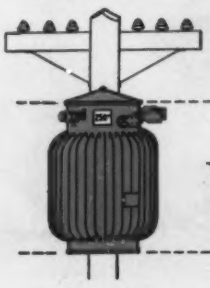
have your

Westinghouse representative

tell you how you can

SERVE BULK LOADS FROM THE POLE TOP

Now—a 250-kva transformer (1700 lbs) to serve a heavy, concentrated load from the pole top . . . another answer to changing needs from Westinghouse Plowback into distribution transformer development. J-70835



YOU CAN BE SURE...IF IT'S

Westinghouse

More New Products

"Building block" design of **contactors and relays** allows assembly of 100 or more types of devices from stock of as few as 12 component parts.—General Electric Co, Schenectady 5, N. Y.

Battery-powered **"walkie" truck** handles cable reels from 36- to 90-in. diameter, up to 68-in. width. Capacities up to 20,000 lb.—Lewis-Shepard Products, Inc, Dept R-21, 125 Walnut St, Watertown 72, Mass.

Service entrance panel features 100-amp main pullout disconnect with 8 to 20 circuits. The single-phase, 120-240-v-ac, 3-wire panel takes 100-amp line connectors up to 1/0 AWG.—Murray Mfg Corp, 1250 Atlantic Ave, Brooklyn, N. Y.

Compact **terminal block** is available for custom assembly or can be supplied in strips rated 600 v ac or dc, 15, 25, and 50 amp. Individual blocks snap on strip. Marking strip snaps into place on blocks—Gemco Electric Co, 25685 W. Eight Mile Rd, Detroit 40, Mich.

Whiteprint machine prints and develops at speeds up to 100 ft per min, takes material up to 54 in. wide. Intensity of 9,000-w light source is variable.—Ozalid Div, General Aniline & Film Corp, Johnson City, N. Y.

Brake for fractional hp motors in frames 56-C and 66-C and integral motor frames 182 and 184 on stub, extended or through shaft applications has single solenoid, lever action, "unitized" construction.—Stearns Electric Corp, 120 N. Broadway, Milwaukee 2, Wis.

Erratum

Relamping of an underwater swimming-pool light from Revere Electric Mfg Co described in EW, Dec. 2, 1957, p 83, requires no lowering of pool water level, but unit must be removed from water and lamp changed on deck of pool. EW reported that lamps could be changed underwater.

CATALOGS–BULLETINS

• **MISCELLANEOUS:** The following bulletins are published by General Electric Co:

Speed Measurement: Four bulletins (3 pp each) describe differential speed recorder, speed ratio recorder, speed deviation recorder, multirange expanded-scale speed recorder. The basic instrument—potentiometer recorder—and the tachometer generator used with it are described separately. Available singly or all together. (EW-1261)

Fixed Pole-Top Capacitor Equipments (8 pp) lists weights, ratings, dimensions in addition to describing and picturing equipment. (EW-1262)

Speed Variators (16 pp) describes a line of packaged dc adjustable-speed drives. (EW-1263)

Front-Connected Dc Crane Control (8 pp) discusses line of control panels and gives typical speed-load and torque-speed performance curves. (EW-1264)

High-Speed Synchronous Motors (8 pp) describes large motors of 1,500 hp and up, their features and applications and company services provided. (EW-1265)

• **SERVICE MAST KITS:** Porcelain Products Co offers a 4-p folder on two service entrance mast kits. (EW-101)

• **WEATHER ENGINEERING:** Case histories showing how weather engineering can help business are an important part of the 18-p booklet "Weather Engineering for Profit." It is published by Weather Corp of America. (EW-102)

• **SILENT CHAIN DRIVES:** Book from Link-Belt Co contains 88 pp of detailed engineering data on silent chain, and illustrations of its uses. (EW-103)

• **LAB & INDUSTRIAL EQUIPMENT:** Thermo Electric Mfg Co has published a 20-p illustrated catalog covering its line of electric furnaces, temperature controllers, pyrometers, and other laboratory and industrial equipment. (EW-104)

• **DISTRIBUTION TRANSFORMERS:** R. E. Uptegraff Mfg Co gives engineering data on four series of dry type distribution transformers in a 12-p manual. (EW-105)

• **INDUCTION UNITS:** From Lindberg Engineering Co a 12-p catalog describes the complete line of high frequency induction units and accessories for rapid high-temperature combustion of laboratory samples. (EW-106)

• **LIGHTNING ARRESTERS:** Complete tables of impulse spark-over voltages and discharge voltages are included in Line Material Industries' 6-p bulletin on intermediate class arresters. (EW-107)

• **COPPER FOIL:** An 8-p illustrated booklet suggesting commercial applications of copper foil has been published by The American Brass Co. (EW-108)

• **DISTRIBUTION TRANSFORMERS:** Delta-Star Div of H. K. Porter Co has published a 4-p bulletin on single-phase distribution transformers, 15 kv and below. (EW-109)

• **FLUE GAS ANALYZER:** A 4-p bulletin describes Leeds & Northrup Co's system which measures air oxygen directly. (EW-110)

• **CONTROL LOCK:** A folder of information on a vibration-proof, automatic, irreversible control lock has been compiled by Reid Metal Products, Inc. (EW-111)

• **AC MOTORS:** Totally-protected ac motors from 1 through 125 hp are discussed in a 4-p bulletin from Reliance Electric & Engineering Co. (EW-112)

TECHNICAL LITERATURE

INDUSTRIAL TRUCKS—The Industrial Truck Association, 9th & F Sts, Washington 4, D. C. has published a 96-p handbook of truck operating data and case studies of truck applications. Entitled "The Handbook of Powered Industrial Trucks," it is available from the Association at a cost of $5.00 a copy.

POLYETHYLENES—A 12-p booklet from the Bakelite Co, 30 W. 42nd St, New York 17, N. Y. gives diagrams and technical data on the use of polyethylene insulation and jacketing for high-voltage power cable.

TRANSFORMER STANDARDS—The EEI-NEMA Joint Committee on Standards for Distribution Transformers has issued a report on certain three-phase, liquid-immersed, subway- and vault-type secondary network transformers. EEI No. 57-7; NEMA No. TR 4-1957. ($0.80)

AIEE PUBLICATIONS—The following publications have been issued by the American Institute of Electrical Engineers, 33 W. 39th St, New York 18, N. Y. Where no price is indicated, the publication is free.

Digital Computers for Power System Problems. 28 pages; $2.00. (No. S-90)

Proposed Guide for Operation & Maintenance of Turbine-Generators. 26 pages (No. 67)

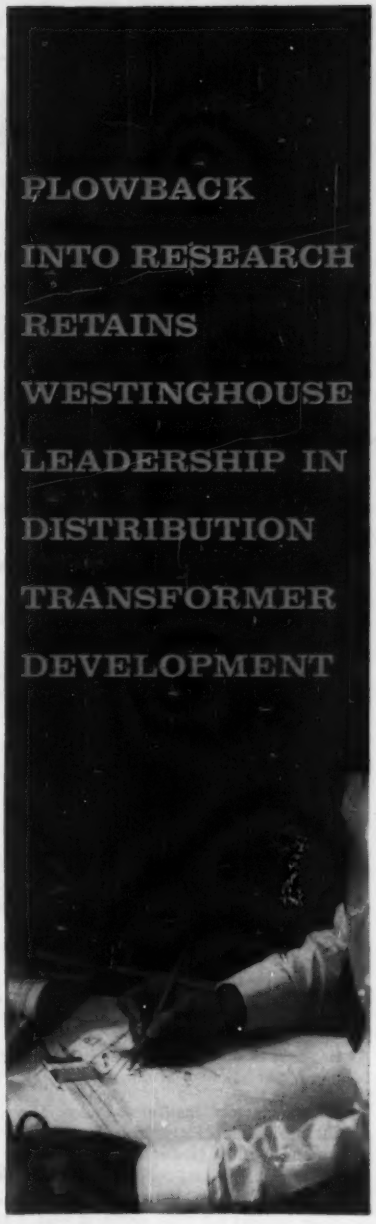
Test Code for Transistors, Semiconductor Definitions and Letter Symbols. 40 pages; $1.20. (No. 425)

Test Code for D-c Machines. 26 pages; $0.60. (No. 501)

Proposed Test Code for Aircraft Equipment Electrical Insulation. 8 pages; (No. 803)

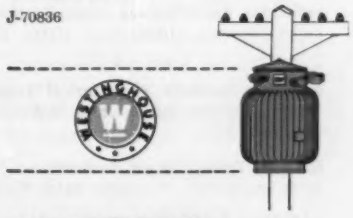
Automatic Station Control, Supervisory, and Associated Telemetering Equipments. 25 pages; $1.30. (No. C37.2)

Step-Voltage and Induction-Voltage Regulators. 47 pages; $2.00. (No. C57.15)



WATCH THESE PAGES
FOR THE BIGGEST NEWS
OF 1958

J-70836



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Westinghouse

The Meetings Calendar

JANUARY

International Home Furnishings Market—Including Appliance Show, The Merchandise Mart, Chicago, Ill., Jan. 6-17.

• **Fourth National Symposium on Reliability and Quality Control in Electronics**—Statler Hotel, Washington, D. C., Jan. 7.

Edison Electric Institute—Home Service Committee, Chicago, Ill., Jan. 8; 2nd Annual LBE National Women's Conference, Edgewater Beach Hotel, Chicago, Ill., Jan. 9-11; Industrial Relations Committee, Mayflower Hotel, Washington, D. C., Jan. 16-17; Dealer Coordination Committee, EEI Headquarters, New York City, Jan. 30-31.

Instrument Society of America—Boston Section, Yankee Instrument Fair & Symposium, Hotel Bradford, Boston, Mass., Jan. 14-15.

Southeastern Electric Exchange — Personnel Administration Section, Biltmore Hotel, Atlanta, Ga., Jan. 16-17.

New England Farm Electrification Institute—University of Massachusetts, Amherst, Mass., Jan. 22-24.

Public Utilities Advertising Association—Regional Meeting, San Francisco, Calif., Jan. 23-24.

Industrial Heating Equipment Association — Penn-Sheraton Hotel, Pittsburgh, Pa., Jan. 27-28.

American Society of Heating and Air-Conditioning Engineers—64th Annual Meeting, Penn-Sheraton Hotel, Pittsburgh, Pa., Jan. 27-29.

Home Improvement Products Show—Hotel Sherman, Chicago, Ill., Jan. 27-29.

Annual Doble Engineering Clients Conference—Sheraton-Plaza Hotel, Boston, Mass., Jan. 27-31.

Pennsylvania Electric Association—Engineering Section, Prime Movers and Structures & Hydraulic Committees joint meeting, Pocono Manor Inn, Pocono Manor, Pa., Jan. 30-31.

FEBRUARY

National Association of Purchasing Agents—Public Utility Buyers Group Mid-Winter Meetings, Sheraton Hotel, Philadelphia, Pa., Feb. 2-4.

National Rural Electric Cooperative Association—Annual Meeting, Memorial Auditorium, Dallas, Tex., Feb. 2-6.

Edison Electric Institute—Prime Movers Committee, Penn-Sheraton Hotel, Pittsburgh, Pa., Feb. 3-5; Industrial Electrification Heating Conference, Netherland Hilton Hotel, Cincinnati, Ohio, Feb. 3-6; Industrial Power & Heating Group, Netherland Hilton Hotel, Cincinnati, Ohio, Feb. 6-7; EEI-AGA 1958 Conference Final Planning Meetings, Ben Franklin Hotel, Philadelphia, Pa., Feb. 6-7; Electrical Equipment Committee, Dayton Biltmore Hotel, Dayton, Ohio, Feb. 10-11; Transmission & Distribution Committee, Lord Baltimore Hotel, Baltimore, Md., Feb. 11-12; Meter & Service Committee, Sheraton Hotel, Philadelphia, Pa., Feb. 17-19.

Industrial Electrification Council—National Industrial Heating Conference, Netherland Hilton Hotel, Cincinnati, Ohio, Feb. 3-6.

American Institute of Electrical Engineers—Winter General Meeting, Statler and Sheraton-McAlpin Hotels, New York City, City, Feb. 3-7.

Missouri Valley Electric Association—Industrial & Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 6-7.

NATIONAL ELECTRICAL WEEK WILL BE OBSERVED FEBRUARY 9-15.

American Public Power Association—Engineering & Workshop Meetings, Chattanooga, Tenn., Feb. 13-14.

National Society of Professional Engineers—Spring Meeting, Michigan State University, East Lansing, Mich., Feb. 13-15.

American Institute of Mining, Metallurgical, and Petroleum Engineers—Annual Meeting, Hotel Statler, New York City, Feb. 16-20.

National Wiring Sales Conference — Statler Hotel, Detroit, Michigan., Feb. 20-21.

Pennsylvania Electric Association—Relay Committee Winter Meeting, Bellevue-Stratford Hotel, Philadelphia, Pa., Feb. 13-14; System Planning and Transmission & Distribution Committees joint meeting, Penn-Sheraton Hotel, Pittsburgh, Pa., Feb. 20-21; Electrical Equipment Committee Winter Meeting, Hotel Roosevelt, Pittsburgh, Pa., Feb. 27-28.

MARCH

Southern Safety Conference, Inc—Exposition, Peabody Hotel, Memphis, Tenn., March 2-4.

• **Pacific Coast Electrical Association**—Business Development Section, Statler Hotel, Los Angeles, Calif., March 6-7; Engineering & Operations Section, Sheraton Palace, San Francisco, Calif., March 27-28.

Lighting Lamps and Electrical Manufacturers Salesmen's Association—First National Lighting Exposition, Coliseum, New York City, March 9-12.

Nuclear Congress—Co-sponsored by American Society of Mechanical Engineers and the Engineers Joint Council, International Amphitheater, Chicago, Ill., March 16-22.

National Association of Corrosion Engineers—Annual Conference & Exhibition, Municipal Auditorium, San Francisco, Calif., March 17-21.

American Society of Mechanical Engineers—Management Conference Committee, Hotel Somerset, Boston, Mass., March 19-20.

Edison Electric Institute—Industrial Relations Committee, Headquarters, New York City, March 20; Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., March 24-27.

Institute of Radio Engineers—National Convention, Waldorf-Astoria Hotel and New York Coliseum, New York City, March 24-27.

American Power Conference—20th Anniversary Meeting, Sherman Hotel, Chicago, Ill., March 26-28.

Southeastern Electric Exchange—Annual Meeting, Boca Raton Hotel and Club, Boca Raton, Fla., March 31-April 2.

• Additions this week.

MORE BIG DATES FOR '58

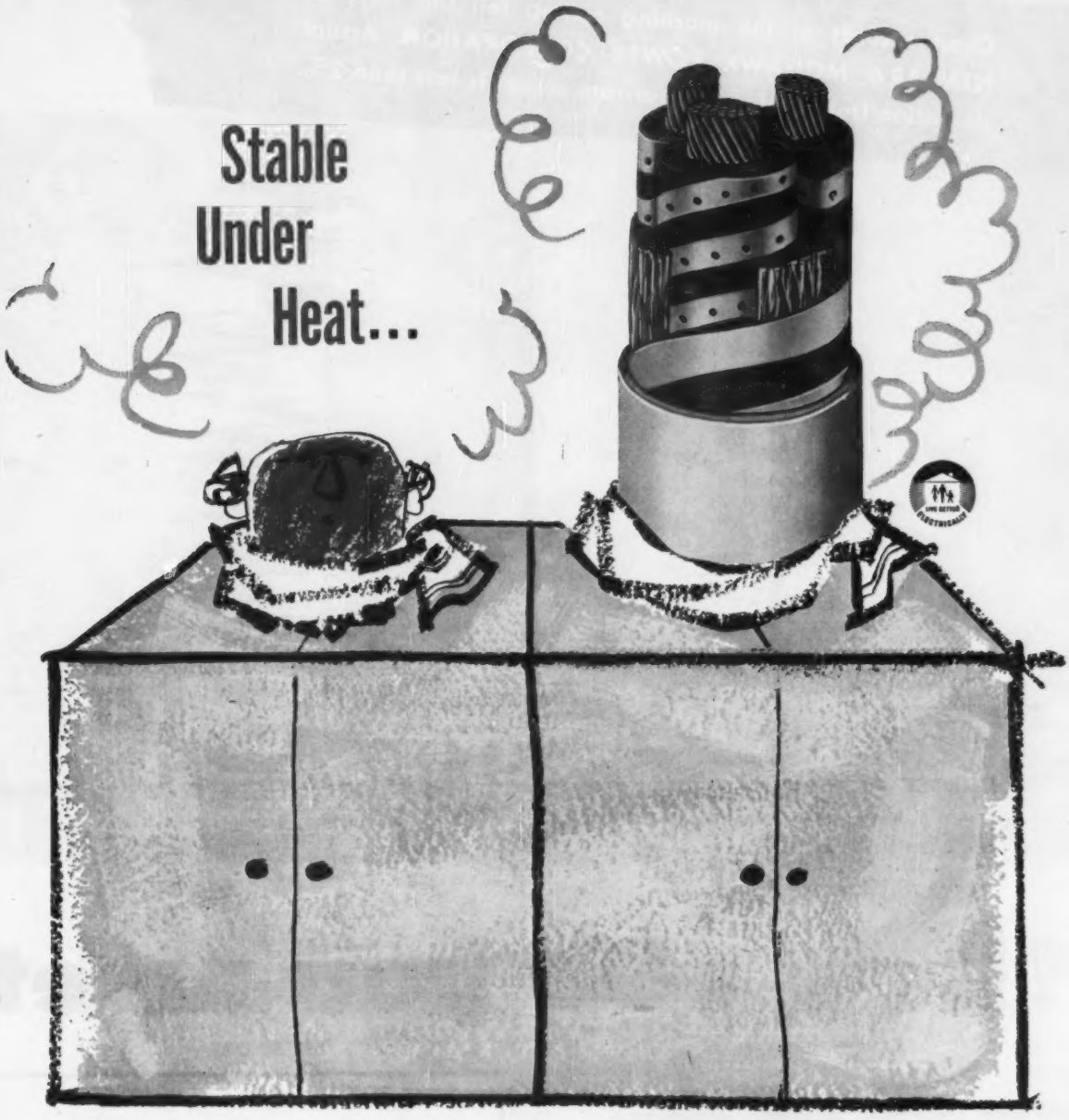
American Public Power Association—Annual Meeting, New Orleans, May 6-8.

National Association of Purchasing Agents—Annual Convention, Chicago, May 11-14.

Edison Electric Institute—26th Annual Convention, Boston, June 9-12.

American Institute of Electrical Engineers—Summer General Meeting, Buffalo, June 22-27.

National Electrical Manufacturers Association—Annual Meeting, Atlantic City, Nov. 10-14.



the Tellurium Lead-Alloy-Sheath on Roebling Paper Power Cable

Sheath temperatures during wiping operations are in the range of 400°F, emphasizing the importance of heat stability. And you'll find that Roebling Tellurium Lead Alloy Cable Sheath retains its excellent creep resistance and bending fatigue resistance even after being subjected to this high temperature.

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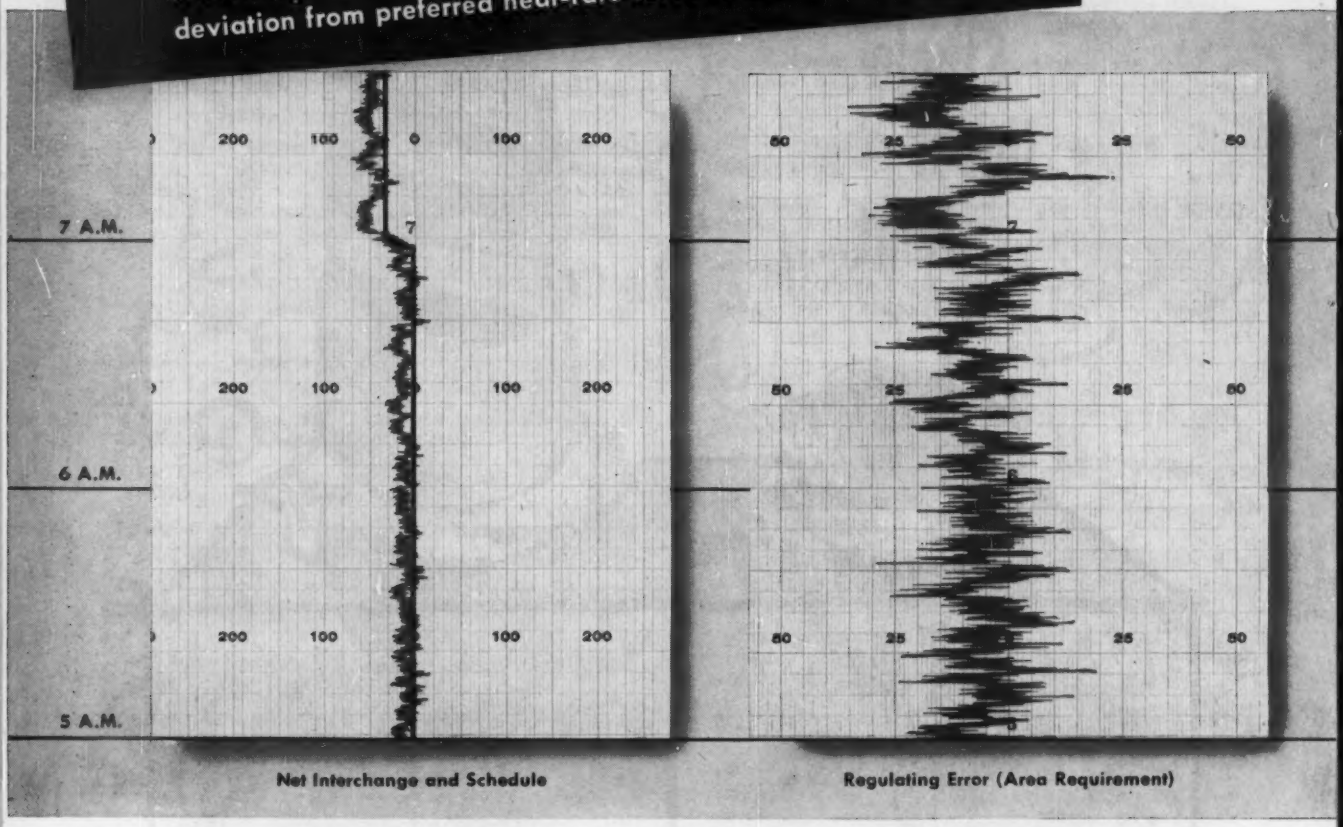
Chart records of the morning pickup tell the story at NIAGARA MOHAWK POWER CORPORATION. Actual deviation from preferred heat-rate curves is less than 2%.



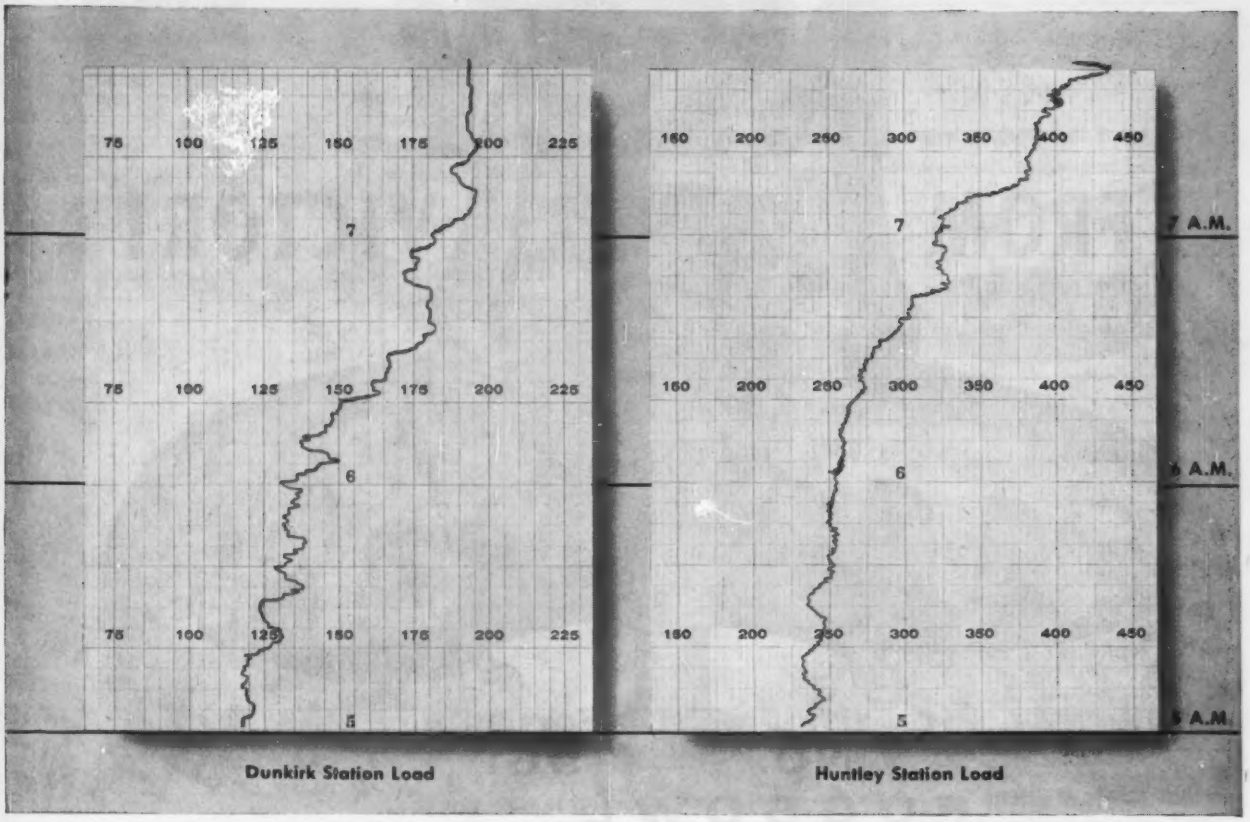
Net Interchange and Schedule

Regulating Error (Area Requirement)

Do you meet

NIAGARA MOHAWK POWER CORPORATION'S WESTERN DIVISION has complete automatic control, from ties to generators, with its Honeywell all-electronic load and frequency control system. The system maintains net interchange schedule of 4 ties by controlling output of 8 steam-electric generators.

This 30-inch wide control console, in dispatcher's office at Buffalo, permits fast, easy adjustment for all conditions.



demand this well?

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- Continuous economic loading with linear control action
- Penalty factor adjustment
- Continuous, simultaneous fringe and sustained control
- Control accuracy unaffected by voltage changes and phase shift
- Small space requirements, lowest installation costs
- Easily expandable, adaptable to control of interconnected systems
- Continuous heat-rate curves through full regulating range
- Positive rate limiting on each generator
- Solid state governor motor actuator

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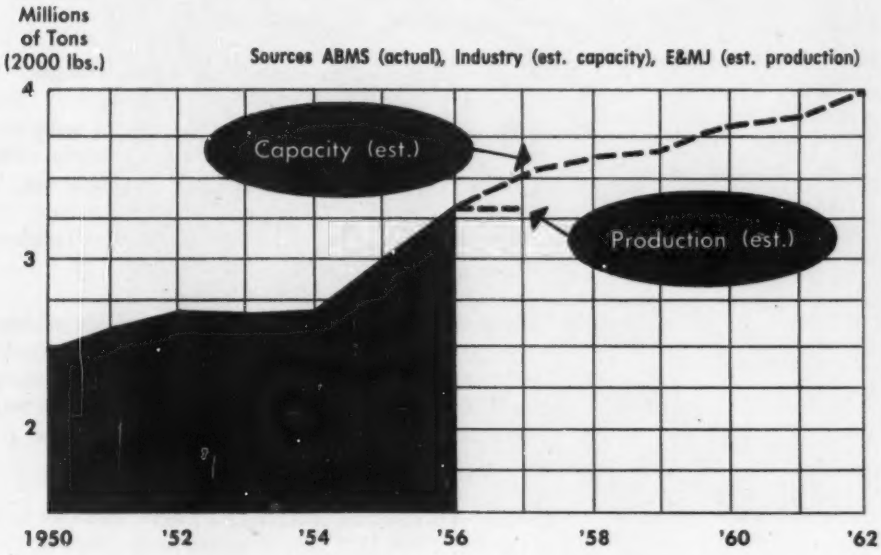
The Electrical Business Outlook



Copper Strives for '58 Stability

Three years of violent tremors in the copper market may subside in 1958. In the past month a number of copper producers decided to cut back production; Kennecott Copper Corp, largest U. S. producer, is curtailing operations by 12% and Union Miniere du Haut Katanga, with extensive holdings in the Belgian Congo, contemplates a cut in '58. Other large producers had already limited production, and more are expected to follow. This trend shows up in the chart above. For the first time in recent history, 1957 will end up with free world copper production running significantly below capacity.

Output cuts presage a balance between supply and demand in 1958, and probably represent the last beam in a structure to support copper prices at or near their present level.

If the cutbacks are effective, 1958 will mark the first time copper supply and demand have balanced in several years, and the first year since 1954 when copper prices have kept a measure of stability. Producer prices rose from 30¢ a pound in early 1955 to 46¢ a pound in March 1956. During the past 21 months they have plummetted to 27¢.

Prior to 1956 copper had been in short supply since World War II, except during periods of recession. Government stockpiling and the post-war consumer boom kept the copper industry going at full speed in an effort to keep up with demand. In 1955 strikes in Rhodesia, Chile, and the U. S. cut into the already inadequate supply, and prices soared.

In 1956 and 1957 increased output, reduced government stockpiling, and a slower industrial pace teamed up to bring prices crashing down. The sharpness

(more)

of the drop was exaggerated by the fact that many users, who had accumulated inventories when they could during the years of scarcity, lived off their stocks and watched the market fall.

Price fluctuations are not strange to the copper industry. Free-world copper comes mainly from Chile, Africa, and the U. S. Since each of these sources contributes a large part of the total free-world supply, anything that affects production in one country is felt in all markets.

The markets themselves promote rapid price changes. The most stable price in this country is quoted by the "big three" producers (Anaconda, Kennecott, and Phelps Dodge) that mine, smelt, refine, and to some extent fabricate their own copper. But the custom smelters, who buy ore from smaller producers, and must adjust their prices more frequently, are also important. Most sensitive market of all is the London Metal Exchange, whose prices sway with speculative sentiment as well as normal supply and demand. And any London price change affects the custom smelters and the big producers also.

Copper production is ill-suited for such a fickle pricing arrangement. It takes five to seven years for a mine to go into operation, from prospect to production. Before spending the enormous sums of money necessary for development, producers must be sure they can sustain a high rate of production, since overhead costs remain high regardless of the amount of copper produced. In the copper industry, cutting back production is a drastic step.

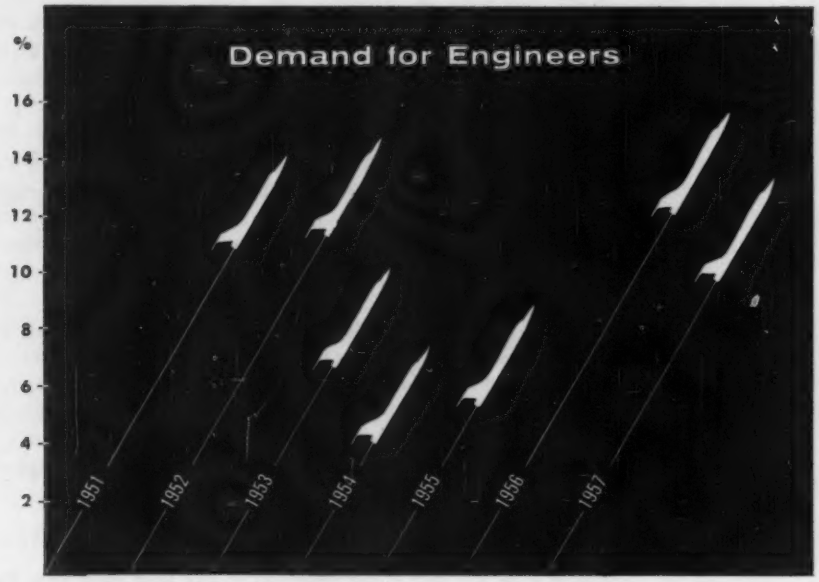
In spite of production cuts, copper will be available in 1958. At the beginning of October 1957, U. S. sellers' refined stocks stood at 173,679 tons—about a 48-day supply at the '57 delivery rate. Prospects for labor peace are good—three-year contracts with major U. S. mining companies were signed in 1956. Capacity will keep rising, according to U. S. copper producers. By 1962 the Copper and Brass Research Assn puts free world capacity at about 4 million short tons—14% above present levels. Developed or indicated reserves add up to about 50 years' supply at current level of consumption, ignoring any additional discoveries.

Prices may stabilize at around 30 or 32¢ a pound. McGraw-Hill's Engineering and Mining Journal feels that such a price may permit long-run copper production sufficient to meet the needs of a moderately expanding economy. About 25% of current copper output cannot be processed at significantly less than that. At the same time, it is unlikely in '58 that prices will repeat their 1955-56 trip to the moon. Today copper prices must stay competitive in order to hold some markets. Many sellers expect a moderate upward glide to be the long-term price trend for copper.

Summary of U. S. Refinery and Fabricator Inventories in Relation to Required Working Stocks

	Copper Producers and Refiners (tons of 2,000 lb.)				Fabricators (tons of 2,000 lb.)		
	Refinery Capacity (a)	Inventories (b)	Required Working Stocks (c)	Ratio: Inventories to Requirements	Inventories (d)	Required Working Stocks (e)	Ratio: Inventories to Requirements
End of 1937	1,642,000	189,702	51,000	3.7	362,115	203,664	1.8
End of 1946	1,800,000	65,926	57,000	1.2	394,123	270,398	1.5
End of 1956	2,064,000	115,774	98,500	1.2	437,187	336,217	1.3
Sept. 1957	NA	173,679	92,000	1.9	425,168	334,530	1.2

(a) ABMS Yearbook, Page 22. (b) USCA, Col. 28. (c) est. (d) USCA, Col. 10. (e) USCA, Col. 41.



Engineers Easier to Find in '57

The engineer shortage eased in 1957, according to the Engineers Joint Council. Demand for engineers by industry and government slipped back from the 1956 high, and industry expected to hire all but 2.5% of the engineers required. The government was not so optimistic, expecting to end the year with an 11% deficit. Employers questioned anticipated a numerical shortage of 6,500 engineers.

Since 1951 the EJC has kept tabs on the engineer shortage by surveying industry and government as to their needs for engineering personnel during the year, and their opinions of how many engineers they will actually be able to get on the payroll. Results of this survey also show trends in turnover rates and hiring of technicians. They also give a record of the actual number of engineers hired the year before.

Last summer, EJC queried 407 industrial concerns and 64 government agencies. These employers, the Council found, needed to hire 17,820 additional engineering graduates in 1957 to meet their requirements. This figure is in addition to the new hirings needed to replace the year's losses. By expressing this number of required net accessions as a percentage of the total engineering graduates employed at the beginning of 1957, EJC comes up with an index of demand.

In 1957 demand for engineers dropped to 12.1% representing a total of 33,156 engineers. The chart above shows that this is higher than in 1953 to 1955, but lower than the record year 1956, when demand reached 14.3%.

And EJC found that more engineers are becoming available. The 1957 graduating class in engineering numbered approximately 31,000—about 20% more than the class of '56. In addition, reduced armed forces commitments meant a higher percentage available for the engineer market upon graduation.

(*more*)

Utilities expected to fill all but 2.3% of their needs for engineers in 1957. (The figures on utilities include also sanitary services, as EJC lumps them together into one category for purposes of the survey.) This compares favorably with the all-industry average, which shows a 2.5% deficit.

And utilities had the lowest expected turnover of engineers in all industry, the council found. Utilities expected to lose 3% during the year, as opposed to an 8% turnover rate foreseen for industry as a whole. The actual turnover in 1956 was 4.7% for utilities, and 8.8% for all industry.

Six engineering technicians are employed by utilities for every 10 engineers. This is almost exactly the all-industry ratio. EJC noted that technicians seemed to be thinning out in industry and increasing in government service. This reflects the easier time civilian industry expected to have in hiring graduate engineers—as well as the pinch on the government.

Engineers Joint Council was careful about making projections from the survey. They noted that the supply-demand situation may be in close balance for the next few years, barring an upward shift in the overall economy or increased defense spending. (The survey was pre-Sputnik.) The council pointed out that a big missile budget would keep the engineer shortage going, and stressed: "This is a snapshot of the present and not a picture of the future."

FINANCE

Electric utility common stocks held their own through 1957. Striking evidence of their value as protective investments in times of drastic stock market decline is furnished by their behavior during the fluctuations of '57.

The New York Times combined 50-stock average showed a decline of over 22% from Dec. 31, 1956, to the close on Dec. 18, 1957. This level represented about a 2½-year low according to all significant stock market averages.

But electric utility common stocks actually rose during that period. Average price of those listed on the New York Stock Exchange at the Dec. 18 close was a small fraction of 1% higher than the average of the same stocks on Dec. 31, 1956.

Furthermore, if allowance is made for two stock splits that occurred in '57, average price of these stocks showed a gain of nearly 3% over the end of last year. Of 64 stocks included in the comparison, 32 showed an increase in price, 29 a decline, and three were unchanged.

EMPLOYEE RELATIONS

UWUA bid for a representative election among full-time employees of Carolina Power & Light Co's "Northern Division" was turned down by the National Labor Relations Board recently. Reason: Board upheld the company's contention that they have no "Northern Division."

Union's alternative plan, for a representative election in any unit the NLRB found appropriate, also was turned down. Board said that while CP&L's Central Service Area would be an appropriate one, UWUA's "showing of interest is not sufficient to warrant holding an election among the employees" in that area.

A group major medical expense insurance plan for active and retired employees and dependents was installed by Union Electric Co. For a copy of the plan, write C. R. Stockhus, VP, Union Electric Co, St. Louis, Mo.

M. W. CRESAP, JR

G. A. PRICE

Cresap Becomes Westinghouse President

Westinghouse Electric Corp has made eight new executive assignments at the policy, administrative, and operations levels. They are:

- Gwilym A. Price, president since 1946 and chairman since 1955, becomes chairman.
- Mark W. Cresap, Jr, vice president and a director since 1955, becomes president and chief administrative and operating officer of the company.
- E. V. Huggins becomes vice president and chairman of the board's executive committee.
- John K. Hodnette becomes executive vice president.
- George G. Main becomes vice president-finance.

Company also formed a policy and finance committee, with Price as its chairman. Members include Cresap and Huggins. Committee will shoulder primary responsibility for the company's business policies.

Cresap also will be a member of other board committees, and chairman of all management committees, except as he may delegate this responsibility.

Huggins will be responsible for the company's relations with the U. S. government, and have general supervision of the Westinghouse defense products division.

Hodnette will, in addition to his other functions, act as deputy to the president relative to activities of the general manager.

Main will be responsible for both treasury and accounting departments.

Other personnel changes:

- Francis E. Dalton becomes controller.
- Carlisle P. Myers continues as general counsel and becomes corporate secretary.
- Russell B. Read continues as planning director and becomes assistant treasurer.

E. V. HUGGINS

J. K. HODNETTE

G. G. MAIN

Aymond Becomes Executive VP

A. H. AYMOND, JR

Alphonse H. Aymond, Jr, has been elected vice president in charge of legal, accounting, and gas matters for Consumers Power Co. He will be succeeded as general counsel by H. P. Graves, formerly general attorney.

Birum G. Campbell, division manager at Kalamazoo, has been elected vice president in charge of sales and business promotion.

John B. Simpson, general supervisor of gas operation, has been made vice president in charge of gas operations also.

Walter C. Schmidt, general supervisor of construction, becomes manager of engineering and construction.

Dayton P&L Elects Two Vice Presidents

S. J. SCHIML

Two new vice presidents have been elected by the board of directors of Dayton Power & Light Co. They are: Samuel J. Schiml, controller, and Edwin D. Smith, manager of the public and industrial relations divisions. Both will continue their same duties.

Schiml began with the company in 1927 as a clerk in the gas meter department. He was appointed as supervisor of the general accounting department in 1948. He was promoted to assistant controller in 1950.

Smith joined DP&L as a district lighting representative in 1928. In 1934 he became assistant supervisor of the Rural Department and rose to supervisor in 1945.

E. D. SMITH

PERSONAL BRIEFS

Bryan Bell Marsh has been advanced from manager of Alabama Power Co's Southern Division to division vice president. He succeeds **A. S. Coleman,** retired. In other company promotions, **James T. Nolen, Jr,** was named Southern Division manager; **C. T. Brasfield, Jr,** became manager of employee relations; and **Robert M. Bishop** was made Southern Division's superintendent.

Detroit Edison Co's engineering coordination and services dept has named **Willis E. Losie** as its new director to replace **Simon Roth,** retired.

Joseph F. Farley succeeds **H. C. Flack,** retired, as comptroller of New York State Electric & Gas Corp.

Francis M. Staszesky is new superintendent of Boston Edison Co's engineering and construction department and **Maurice J. Feldmann** becomes assistant superintendent, E&C. **Robert M. Lewis** was named head of the coordinating and expediting division, E&C, and **Benjamin H. Weiner** became engineer on the staff of Pres **Thomas G. Dignan.**

Recently promoted at Central Power & Light Co were **A. L. Lacey,** to Corpus Christi manager; **Thomas B. Gunter,** to training director; **W. E. Meehleib,** to commercial manager.

W. J. Amoss is newly named president of Cia Cubana de Electricidad, subsidiary of American & Foreign Power Co. He succeeds **D. G. Lewis** on Jan 1, when the latter moves to New York as vice president of A&FP. In another appointment, **Kenneth Haines** was transferred to Venezuela to help organize the economic development department of Cia Anonima Luz Electrica de Venezuela.

The Micarta Division, Westinghouse Electric Corp, has named **Herbert C. Smith** sales manager. He succeeds **S. F. Davies,** new director of marketing, general products group. Other new marketing directors are **L. H. Loufek,** apparatus products; and **R. M. Wilson,** defense divisions.

Percy L. Spencer has been elected senior vice president of Raytheon Manufacturing Co . . . Perkin Engineering Corp's new VP is **T. W. LeNay,** chief development engineer.

Manufacturers Expect '58 Sales Gains

More steady growth is the present opinion of electrical equipment manufacturers and related associations in reporting their 1958 forecast of business. Here are more predictions. These are in addition to those presented in the Dec. 30, 1957 issue.

Anderson Electric Corporation

"With respect to 1958's billings, we expect to experience a level of approximately 5% less than the 1957 sales on the presently catalogued line. Certain new products will be released during the first part of 1958 which will improve our billings. Numerically, shipments will be about the same with the average dollar value per shipment slightly down."

Thomas H. Fox, President

Babcock & Wilcox Company

"New orders for our steam generating equipment in 1958 may be off about 25% from 1957. Because of the high level of orders received two years ago, we will have a substantial volume of shipments of steam generating equipment during the coming year. Shipments in our Tubular Products and Refractories Divisions will probably be at a lower level than in 1957.

M. Nielsen, President

A. B. Chance Company

". . . is forecasting an increase in sales billed for 1958. Increased labor, material and freight costs have put a real squeeze on profits. In many cases price levels have not kept pace with cost increases. Physical inventory has increased and we expect it to increase further in order to give good service."

L. C. Hansen, Director of Marketing

Federal Pacific Electric Company

"Market for our equipment should remain on its present high plateau during 1958. With continuing strong demand for utility apparatus, combined with substantial backlogs, our sales should show a 15 to 20% increase by the year end."

Robert C. Graves, Vice President-Sales

Four Wheel Drive Auto Company

". . . anticipates an overall sales increase, for all markets, of 20% to more than $25 million in 1958. This includes an expected rise of approximately 30% in sales to electric utilities."

G. F. DeCoursin, Vice President-Sales

General Cable Corporation

"Although unit volume in 1958 of our industry and General Cable specifically will, we believe, continue at a relatively high level, the lower prices for copper and lead may result in lower dollar volume."

A. Wacker, Vice President

Kaiser Aluminum & Chemical Corp

"We look to 1958 with considerable optimism. In 1957 we added an outstanding new product to our line in the form of expanded core 345-kv transmission cable. This is proving highly successful in the field. Also, recent successful experiences in numerous industrial, school, bank and hospital installations presage much potential for aluminum building wire in the coming year."

J. T. Dugall, General Manager, Electrical Conductor Division

Lapp Insulator Co, Inc

"Almost everyone has profound conviction as to the basic soundness and growth potential of the industry we serve. It is to be hoped that the present uncertainty will not be reflected in a serious cut in construction programs. The insulator industry is not overbuilt and the subsequent effort to "catch up" might well prove extremely difficult."

Brent Mills, Executive Vice President

Line Material Company

". . . views business prospects for 1958 with confidence. We have prepared for increased business in 1958 by expanding our engineering, manufacturing, and marketing facilities."

R. G. Wheaton, President

National Electrical Manufacturers Ass'n

"Electrical manufacturers struck an optimistic note for 1958 by predicting that the electrical manufacturing industry will turn out over $21 billion worth of products. In the midst of considerable skepticism on all sides with many business economists predicting general tapering off in the volume of business next

(*Continued on page* 98)

year the consensus expressed by executives in the electrical manufacturing industry is that the dollar volume of output will be 1% higher in 1958 as compared with 1957. This will mark the third consecutive year in which the dollar value of output of the industry exceeds the $20 billion level."

Joseph F. Miller, Managing Director
A. J. Nesti, Chief Statistician

Preformed Line Products Company

"We expect our average utility level to be substantially the same as 1957. New products and diversified industry acceptance will account for a 10% increase in 1958."

Thomas F. Peterson, President

Edward Valves, Inc.

". . . expects the first half of 1958 to show some increase over the last half of 1957, though the early 1958 level will still be under 1956. This cyclic tendency applies to valves, pumps, instrumentation and all equipment similarly closely associated with boilers themselves".

William F. Crawford, President

Aluminum Association

"Use of aluminum is increasing steadily in all types of packaging . . . and more and more aluminum is being used in the electrical field—in applications such as bus bar, insulated wire and cable and ACSR (aluminum cable, steel reinforced)."

Donald M. White, Secretary

Copper & Brass Research Association

"Anticipating growing demand and striving to achieve stable supplies and prices, American copper producers have been making increasing investments in capital improvement and expansion."

T. E. Veltfort, Managing Director

Reliance Electric & Engineering Company

"We are looking forward to increasing benefits from many of our products which have been and are being redesigned, not only improving their saleability, but bringing about lower cost manufacturing as well."

Edward E. Helm, President

PAGE chain link **FENCE**

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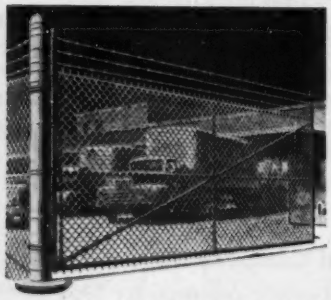

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Southern States Selects Rumsey Electric for Sales

Manufacturer-sales relationship has been made between Southern States Equipment Corp, Hampton, Ga., and Rumsey Electric Co, Philadelphia, Pa.

Southern States manufactures a line of group-operated air switches, disconnects, cutouts, power fuses, substations, power connectors, and related equipment. The company began its operation in Birmingham, Ala., in 1916 and has done pioneering work on high-voltage fuses and switchgear. In 1945 Southern States moved to Hampton, and has expanded rapidly since that time.

Rumsey Electric, a 50-year old sales organization, represents major manufacturers in many categories of electrical equipment and supplies. The company is staffed with 165 people, 30 are graduate engineers.

Rumsey Electric will represent Southern States in Eastern Pennsylvania, New Jersey, Delaware, Maryland, District of Columbia, and major portions of West Virginia and Virginia.

(*More M&M on page* 100)

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THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

Delta-Star #1 Transformer Purchased by Okla. P. S.

Public Service Co of Oklahoma, at Tulsa, purchased Delta-Star Electric Division's distribution transformer, serial No. 1.

After the utility's engineers inspected and approved the Delta-Star design, the unit was put in service. Shortly thereafter Delta-Star was awarded a production order with deliveries scheduled throughout 1958.

Bussman to Market Low-Peak Fuses

Bussman Mfg Division, McGraw-Edison Co, St. Louis, will market Fusetron low-peak fuses having a current-limiting element. This device is reported to cut off fault current rapidly so that it cannot build up to a damaging peak. Protection is provided circuits and components that might be damaged by thermal and mechanical stresses of peak fault currents.

The manufacturer advises that this line of Fusetrons is available in sizes 60 amp and above and in 250 and 600-v ranges.

M & M BRIEFS

Foster Wheeler Corp headquarters offices is now located at 666 Fifth Ave, New York 19, N. Y., telephone JUdson 2-6600.

Copperweld Steel Co has acquired Superior Steel Corp, Carnegie, Pa., a producer of stainless, alloy, and carbon strip steels. Superior will be operated as a Division of Copperweld with Carl I. Collins, vice president in charge.

Franklin Research Corp, Boston, has acquired Fullerton Mfg Corp, Norwalk, Conn., a manufacturer of commercial fluorescent lighting equipment. This line supplements the industrial and street lighting equipment produced by Wheeler Reflector Co, Boston, another associate of Franklin Research.

SALES ASSIGNMENTS

COMPANY STAFFS

Bakelite Co's Extrusion Materials Division has appointed Richard L. Garrison as a technical representative in the Chicago district office. His territory includes principal cities of Minneapolis and St. Paul (Minn.), Milwaukee (Wisc.), Des Moines and Sioux City (Iowa), Fargo (N. D.), Omaha (Nebr.), Denver (Colo.), and Chicago (Ill.).

C & D Batteries, Inc, has transferred George A. Delbos from his post as head of the Boston office to the Detroit area. There he will be in charge of Packaged Electric Power Co, the firm's new Michigan office. He will cover the entire state of Michigan.

General Electric Co's large lamp department has designated George E. Matilo specialist for retail lamp sales through electric utility companies.

Gould-National Batteries, Inc, has appointed F. B. Steele district manager in Chicago, Ill, for its Industrial Division.

Thor Power Tool Co's Milwaukee branch has as its new district sales manager Walter B. Smith. He replaces Clarence B. Bergren, now manager of Thor electric and SpeedTool sales. Theodore E. Vocker assumes Smith's former post of St. Louis branch manager. Other newly appointed district sales managers are: Harry L. Groves, for the Houston branch; Martin A. Bertram, Cincinnati; Samuel P. Gartland, Boston; Thomas J. Murphy, Buffalo (N. Y.); and James Q. Golden, Atlanta (Ga.) branch.

REPRESENTATIVES

Allis-Chalmers Manufacturing Co's Industries Group has made the following appointments: Sikeston Motor & Transformer Co, Inc, Sikeston (Mo.), as agency for feeder voltage regulators and distributor for A-C motors and transformers in counties in southeastern Missouri, southern Illinois, northwestern Tennessee, and southwestern Kentucky; Braid Electric Co, Nashville, as agency for A-C regulators in western Tennessee; Lighting Fixture & Electric Supply Co, New Orleans, as distributor for transformers in the city's industrial trading area; and R. E. Burmeister Electric Co of Minneapolis, as agency for A-C feeder voltage regulators, power transformers, unit substations, switchgear, and circuit breakers in Minnesota, North Dakota, and parts of South Dakota and Wisconsin. New agencies in Oklahoma City for A-C feeder voltage regulators are Electric Supply of Oklahoma, Inc, and Southwest Electric Co.

Westinghouse Electric Corp has named McNamara Sales Co as sales agent in St. Paul for the Sturtevant Division. It will handle commercial and industrial air handling and air cleaning equipment in North Dakota, South Dakota, Minnesota, and northwest Wisconsin.

SEARCHLIGHT SECTION

REPLIES (Box No.): Address to office nearest you
c/o This publication Classified Adv. Div.
NEW YORK: P. O. Box 12 (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

Electrical Sales Engineer—Excellent opportunity with firm of consulting management engineers located in Chicago for electrical engineer with some experience in contracting customers, selling through distributors or retailers or contacting or servicing utilities. Will work under direction of a vice president of company of leading electrical appliance and equipment manufacturer accounts. Will also contact top level officials in manufacturing and electric light and power companies. Travel required from fourth to third of the time. Salary depends upon man's age, qualifications, experience and potential. Send resume, with photo if possible, to Robb M. Winsborough, Vice Pres., Middle West Service Co., Consulting Management Engineers, 20 N. Wacker Dr., Chicago 6, Ill.

Electrical Engineer. Board layout work—power lighting, and control systems; calculations; and occasional field contacts. Extremely wide variety of work with opportunity to enter consulting field and grow with progressive midwestern concern. All replies will be answered. P-6902, Electrical World.

Wanted: Southeast electric utility desires Electrical Engineer for work in distribution engineering. Prefer applicant to have had some experience. Pleasant working conditions. Within 100 miles of Gulf. Salary commensurate with ability, training. Number fringe benefits, opportunity for advancement. P-6912, Electrical World.

Rate Man wanted by utility operating in Southeast. Help design wholesale and retail rate structures. Assist with studies. Salary based on training, experience, and ability to produce. Challenging opportunity. Number fringe benefits, excellent working conditions. Write fully about training, experience, salary requirements. P-6923, Electrical World.

Recently retired Distribution Engineer with field experience. Position open in middle south. P-6667, Electrical World.

Nationally known firm has opening in their Washington, D. C. Office for individual experienced in water resource matters with emphasis on hydroelectric developments. Familiarity with Federal regulatory procedures desirable. Prefer man with previous legal training and experience. Please reply giving age, education, resume of experience and salary expected. P-6809, Electrical World.

Superintendent, Electrical—Large Powerhouse Experience, preferably Hydro. Send resume of education, experience, salary expectations, photo if available, etc. to Electrical Constructors, P.O. Box 2178, Columbus 16, Ohio.

Superintendent, Transmission Line — Steel Tower Erection Experience. Send resume of education, experience, salary expectations, photo if available, etc. to Electrical Constructors, P. O. Box 2178, Columbus 16, Ohio.

EMPLOYMENT SERVICE

Salaried Personnel, $5,000-$30,000. This Confidential service established 1920, is geared to needs of high grade men who seek a change of connections under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, P. O. Box 674, Manchester, Vermont.

DON'T FORGET

the box number when answering advertisements. It is the only way we can identify the advertiser to whom you are writing.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

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EMPLOYMENT OPPORTUNITIES: $19.15 per inch. Subject to Agency Commission. Effective Jan. '58 ($22.67 per inch).
EQUIPMENT & BUSINESS OPPORTUNITIES: $14.00 per inch for all advertising appearing on other than a contract basis . Not subject to Agency Commission. Effective Jan. '58 ($16.85 per inch).
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.
EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

UNDISPLAYED RATE:

$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line. Effective Jan. '58 ($1.80 a line).

PROPOSALS, $1.50 a line an insertion. Effective Jan. '58 ($1.80 a line).

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

SEND NEW ADVERTISEMENTS TO Classified Advertising Div. of ELECTRICAL WORLD, P. O. Box 12, N. Y. 36, N. Y.

ASSISTANT TREASURER
PUBLIC UTILITY

Assistant Treasurer of operating electric and gas utility in Middle Western state to ultimately have primary responsibility for financial and accounting phases of operation. Want college graduate with several years' experience in accounting, finance, treasury, procedures, management. Will be expected to assist in preparation of budgets, projections, financial statements and reports. Preferred age not over 40. Salary dependent upon ability and experience. Good benefit program. We are recruiting this man for a client. Please send complete resume of education, work experience, earnings and personal history to

MIDDLE WEST SERVICE COMPANY
Management Consultants
20 North Wacker Drive Chicago 6, Illinois

ELECTRICAL ENGINEERS
Power Systems—Stations
Substations—Transmission
—Distribution

Attractive working conditions, Profit-sharing, fringe benefits including paid vacations and holidays, insurance and pension plan.

Write: PETER F. LOFTUS CORPORATION
First National Bank Building
Pittsburgh 22, Pennsylvania
Or Call Collect: EXpress 1-2280

FOR SALE
15,000 Kw 13200 Volt
G.E. TURBO-GENERATOR

with condenser, removal pump, dual drive 100 kw exciter.

DUKE POWER CO.
Charlotte, N. C. G. O. Bason

LARGE POWER EQUIPMENT

Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?
BELYEA COMPANY, INC.
81 Hewell St. Jersey City, N. J.
DE. 3-3334

FOR IMMEDIATE SALE
Cooling Tower 500 GPM from 108°F to 85°F at 70°F wet bulb. Mechanical Tower with fan, 220V, 60CY, splash-proof motor.
Contact R. G. Karch,
Utilities Superintendent, Buildings & Properties Department,
Cornell University, Ithaca, New York

ENGINEERING SALES
positions in
PROCESS CONTROL INSTRUMENTATION
- field or home office -

Interested in a sales engineering career in the field of instrumentation and automation? We are looking for qualified engineering graduates, preferably electrical, chemical, or mechanical, between 25 and 35 years of age, with a few years' experience in instrumentation, engineering sales, or industrial processing.

Field locations are in U.S. industrial areas. Home office openings are for sales specialization in electrical instrumentation; or for sales specialization in petroleum, chemical, or metals industry.

Sales aptitude tests given at our expense, plus thorough training course at home office (Foxboro, Mass.) for successful applicants.

If you feel you are qualified for a permanent sales engineering position in this expanding industry, please write (giving outline of education and experience) to

The Foxboro Company, Foxboro, Massachusetts.

FOXBORO
Reg. U.S. Pat. Off.

SENIOR ELECTRICAL ENGINEER
American Company in Venezuela

Responsibilities include:

Reviewing, designing, and cost estimating all phases of electrical engineering work.
Reviewing and analyzing parts requirements.
Analyzing all operating activities involving electrical engineering.
Reviewing and recommending on all requisitions involving electrical engineering.

Equipment involved (electrical):

Conveyor systems, railroad rolling stock, power plants.
Mining and related equipment.

Experience required:

Degree in electrical engineering.
Broad experience in above responsibilities.
Working knowledge of Spanish language desirable.

Excellent financial and promotional opportunity. All replies held in confidence.

Submit qualifications resume to

P-6929, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

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(Used or Surplus New)
For Sale 100

Readers Forum

No More Ragged Edges

To the Editor:

My attention has been directed recently to your column in the *Electrical World,* which carried the headline "Tip No. 4—Save Tear Sheets."

Naturally, many of us here in our general offices have read your comments under this subject with a great deal of interest, not only because the reference was in connection with members of our organization but because many of us have been following the same practice for years.

We are very glad to note your plans to perforate some of the key pages of *Electrical World* beginning next year. This is an excellent idea as it will make it possible for us to remove the sheets which we care to preserve without the ragged edges commonly seen on many of the pages in our files.

D. C. Wester, Director
Employee Relations Department
Kentucky Utilities Company
120 South Limestone Street
Lexington, Kentucky

Cable Marking Needed

To the Editor:

Two years ago I wrote to several large wire manufacturers and suggested that they mark their nonmetallic sheathed cable, service entrance cable, etc. so that an electrician could easily determine how much cable had been used from a roll of cable. This would save much measuring—and estimating of the amount of cable used on a particular job.

I suggested that the cable be marked every foot and that every ten foot section be marked with the number of feet. The second ten foot section would be marked with a "20", etc. up to 100", then start over. The wire manufacturers all advised me that such a marking system was next to impossible. It appears that ingenuity in the wire manufacturing business is at a low ebb.

Does your magazine have the intestinal fortitude to challenge the wire manufacturers to give with a cable marking plan that would help their customers?

Moody H. Mulkey, Jr.
Manager
Middle Georgia Electric Membership Corporation
Vienna, Georgia

Statement Amplified

To the Editor:

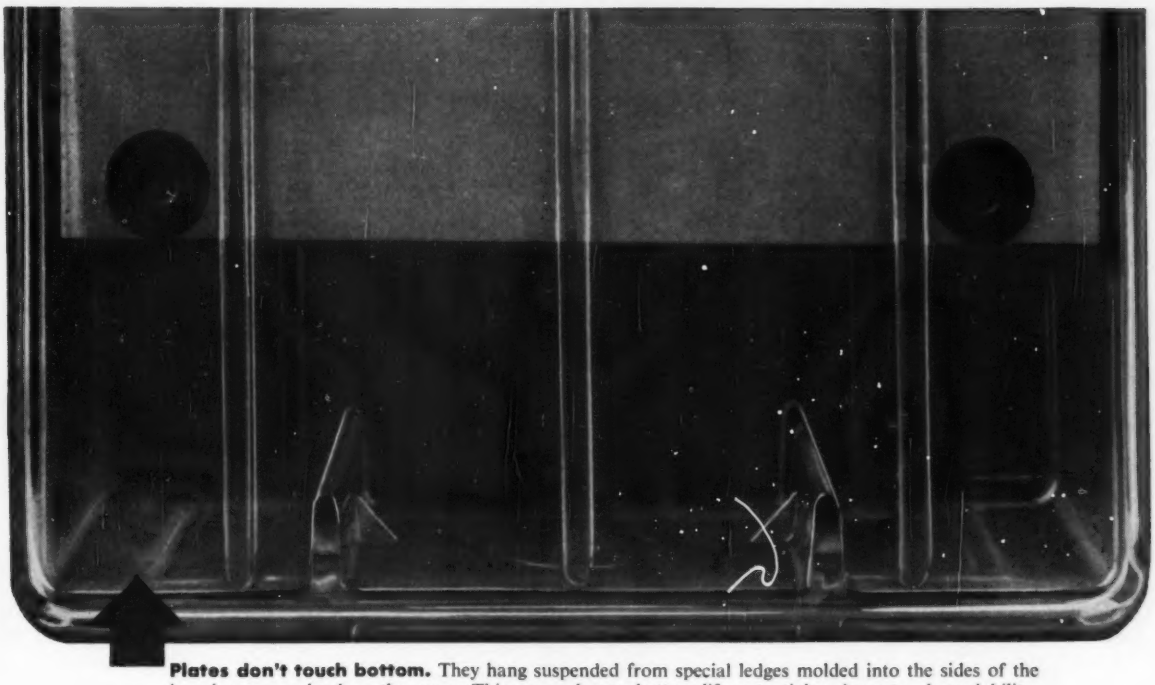
In the Electrical World report on the Fall AIEE meeting in Chicago I am quoted on page 67 of the November 4th issue as saying "selective transfer became essential when the industry went to unitized design." May I correct and amplify this report?

With unitized design another source other than the generator leads is required to bring a boiler up to pressure and to get a machine on the line. If the plant is truly unitized it follows that those auxiliaries which were fed from another source must be transferred to the generator leads after the machine has been phased in. The point I want to emphasize is that transfer facilities must be provided for normal start-up and shutdown. These facilities are there whether or not they are employed for automatic transfer during shutdown. Although seldom necessary, it is usually convenient to automatically transfer certain auxiliaries during shutdown. If multiple boards are employed and selective transferring is used there are few hazards in transferring those auxiliaries whose transfer is a convenience if not a necessity.

C. F. Paulus
The Cleveland Electric Illuminating Company
75 Public Square
Cleveland 1, Ohio

Your Comments Invited

Readers Forum is your column in Electrical World. We invite queries, comments, criticism. For space reasons some letters must be shortened but every effort is made to accurately reflect the view of the writer.



Plates don't touch bottom. They hang suspended from special ledges molded into the sides of the jar—impose no load on the cover. This means longer battery life potential and greater dependability.

NEW EXIDE-MANCHEX BATTERY ...BUILT FOR EXTRA LIFE

Exide-Manchex positive plate. Active material is built up between the spiral layers of these unique lead buttons that act like tiny shelves. Support it against shedding. Reserve lead prolongs battery life.

In the new Exide-Manchex, plates are suspended from the top—do not touch the bottom of the jar at all. So sediment drops right to the bottom, inches away from the plates. It will never, never cause a short.

This new design feature means that Exide-Manchex now has longer life potential than ever. In addition, the new open design spacer, with high porosity, microporous separator, means lower internal resistance and higher capacity. Greater electrolyte reserve means less frequent watering and assures better voltage.

Get complete information on this stationary battery, the finest you can buy. Write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 2, Pa.

Exide®

HOUSEPOWER HIGHSPOTS

Local advertising helps bring prospects to the HOUSEPOWER Coach. Inside, they find appliance and equipment displays, with local contractors to answer their questions.

Detroit Edison's *HOUSEPOWER*[T. M.] Coach attracts 1000 people in one weekend

Electrical contractor shows prospect and his wife how inadequate wiring keeps their electrical equipment from serving them properly, offers them free HOUSEPOWER survey.

Later, at couple's home, the contractor finds that the house is inadequately wired, shows them how full HOUSEPOWER can benefit them, and makes the sale.

Detroit Edison's mobile HOUSEPOWER Coach offers an ideal way to attract new wiring customers, say the 225 contractors who are participating in the utility's HOUSEPOWER program.

To prove the point: On one weekend 1000 prospects visited the coach. Six full HOUSEPOWER jobs were sold in one day, and 35 good leads were developed.

The 34-foot, fully equipped HOUSEPOWER Coach travels throughout Detroit Edison territory, scheduled for high traffic corners and major shopping centers. In each area it is manned by local contractors, who offer free HOUSEPOWER surveys to potential customers.

Detroit Edison backs up the contractors' efforts by featuring HOUSEPOWER displays in its 75 customer offices and by having its employees promote HOUSEPOWER in every customer contact.

"The HOUSEPOWER program offers a challenging opportunity to all of us in the industry to increase electrical sales and to help our customers get the full benefit from their electrical equipment," says George Fluehr, Kuhlman Electric Company president.

Published in the interest of the electrical industry by

KUHLMAN ELECTRIC COMPANY
Birmingham, Michigan

MANUFACTURERS OF DISTRIBUTION AND POWER TRANSFORMERS